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Measuring physiotherapy outcomes in chronic low back pain: Moving forward to a patient-centred approach

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ABSTRACT

Background

Chronic low back pain (CLBP) is a common health condition worldwide affecting multiple domains of people's health and life. The management of CLBP has now a greater emphasis on conservative interventions, such as physiotherapy treatments, and a growing research effort has been undertaken to analyse their effectiveness. Ensuring the integration of the patient's perspective in the measurement of health outcomes is a critical element for effectiveness research and it has become increasingly important in the current patient-centred healthcare paradigm. In particular, the assessment of meaningful outcome domains for patients is now an essential requirement for the adequate outcomes measurement of health interventions. However, growing evidence has suggested that the outcome domains measured in research are not fully aligned with the patients' perspective.

Purpose

The aim of this thesis was to analyse the relationship between the outcome domains used in research and the perception of patients with CLBP about physiotherapy outcomes, contributing to reinforce the patient's role in the physiotherapy outcomes measurement.

Materials and Methods

To achieve this purpose, five studies were developed: 1) The first systematically analysed how the outcomes are being measured in physiotherapy research; 2) The second focused on the cultural adaptation and the psychometric properties analysis of a measure representative of the patient's perception of improvement; 3) The third and fourth analysed the relationship between pain intensity and functional disability domains and the patient's perception; 4) The fifth explored the relevant outcome domains for patients undergoing physiotherapy.

Results

A wide variety of outcome domains are used to determine the physiotherapy effectiveness in patients with CLBP, but poor compliance with a biopsychosocial framework was found. Pain intensity and disability are widely used, while other outcome domains covering the psychological and social health areas are rarely used in the physiotherapy research. However, pain intensity and disability changes during physiotherapy treatment were not sufficient to capture the set of outcomes as

perceived by patients, explaining only partially the global patients' perception of improvement. In addition, the most used pain and disability cut-off values showed a poor ability to identify patients with CLBP who perceived a meaningful improvement after physiotherapy treatment. Patients with CLBP undergoing physiotherapy perceived gains in multiple health domains that ranged beyond those of pain and disability, such as "reducing medication intake", "improving sleep quality", "ability to self-manage" and "sense of well-being and normality".

Conclusions

This thesis contributed to understanding the present gap between the outcome domains used in physiotherapy research and the patients' perspective. Current outcome measurement in physiotherapy research is incomplete and partially covers the set of outcomes perceived as meaningful by patients with CLBP. The outcome measurement model for physiotherapy treatments needs to be rethought and probably expanded to reflect the set of outcome domains valued by patients.

Key words

Chronic low back pain; Physiotherapy interventions; Outcome domains; Health outcomes measurement

RESUMO

Introdução

A dor lombar crónica (DLC) é uma condição de saúde comum a nível global que afeta vários domínios da saúde e vida das pessoas. O tratamento da DLC tem agora maior ênfase nas intervenções conservadores, como os tratamentos de fisioterapia, e um esforço crescente de investigação tem sido realizado para analisar a sua efetividade. Garantir a integração da perspetiva do paciente na avaliação de resultados de saúde é um aspeto fundamental na investigação de efetividade e tornou-se cada vez mais importante no atual paradigma de cuidados de saúde centrados no paciente. Em particular, a avaliação de domínios de resultados relevantes para os pacientes é agora uma condição essencial para uma adequada mensuração dos resultados das intervenções de saúde. Contudo, evidência crescente tem sugerido que os domínios de resultado mensurados na investigação não estão completamente alinhados com a perspetiva do paciente.

Objetivo

O objetivo desta tese foi analisar a relação entre os domínios de resultado utilizados na investigação e a perceção dos pacientes com DLC sobre os resultados da fisioterapia, contribuindo para reforçar o papel do paciente na mensuração dos resultados da fisioterapia.

Materiais e Métodos

Para concretizar este objetivo, foram desenvolvidos 5 estudos: 1) O primeiro analisou sistematicamente a forma como os resultados da fisioterapia têm sido mensurados na investigação; 2) O segundo centrou-se na adaptação cultural e análise das propriedades psicométricas de um instrumento de medida representativo da perceção de melhoria dos pacientes; 3) O terceiro e o quarto analisaram as relações entre os domínios da intensidade da dor e incapacidade, e a perceção de melhoria dos pacientes; 4) O quinto explorou os domínios de resultados relevantes para os pacientes sujeitos a fisioterapia.

Resultados

A efetividade da fisioterapia em pacientes com DLC é determinada através de uma ampla variedade de domínios de resultados, contudo foi encontrada uma baixa concordância com um quadro conceptual biopsicossocial. A intensidade da dor e incapacidade são amplamente utilizados enquanto outros domínios de resultados

abrangendo as áreas de saúde psicológica e social são raramente utilizados na investigação de fisioterapia. Porém, as mudanças na intensidade da dor e incapacidade durante o tratamento de fisioterapia não mostraram ser suficientes para captar o conjunto de resultados tal como percecionados pelos pacientes, explicando apenas parcialmente a perceção global de melhoria. Para além disso, os valores de corte mais usados para a dor e incapacidade mostraram uma baixa capacidade em identificar os pacientes com DLC que percecionaram uma melhoria significativa após o tratamento de fisioterapia. Os pacientes com DLC sujeitos a fisioterapia percecionam ganhos em vários domínios de saúde para além dos domínios da dor e incapacidade, tais como “redução da toma de medicação”, “melhoria da qualidade do sono”, “capacidade de autogestão” e “sensação de bem-estar e normalidade”.

Conclusões

Esta tese contribuiu para compreender a lacuna existente entre os domínios de resultados usados na investigação de fisioterapia e a perspetiva dos pacientes. A atual mensuração de resultados na investigação de fisioterapia é incompleta e abrange parcialmente o conjunto de resultados percecionados como importantes pelos pacientes com DLC. O modelo de mensuração de resultados para os tratamentos de fisioterapia precisa de ser repensado e provavelmente expandido de forma a refletir o conjunto de domínios de resultados valorizados pelos pacientes.

Palavras-chave

Dor lombar crónica; Intervenções de fisioterapia; Domínios de resultado; Mensuração de resultados em saúde

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CLBP – Chronic low back pain

COMET - Core Outcome Measures in Effectiveness Trials

COS – Core outcome set

GPES – Global perceived effect scale

GRCS - Global rating of change scales

ICF - International Classification of Functioning, Disability and Health

IMMPACT - Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials

LBP – Low back pain

MIC – Minimum important change

NPRS – Numeric pain rating scale

OMERACT - Outcome Measures for Rheumatology Clinical Trials

PROM - Patient-reported outcome measure

PROMIS - Patient-Reported Outcomes Measurement Information System

PROSPERO – International prospective register of systematic reviews

QBPDS – Quebec back pain disability scale

YLDs - Years lived with disability

1. INTRODUCTION

Chronic low back pain (CLBP) is an extremely prevalent health problem worldwide with a high individual and societal impact (1–3). In Portugal, CLBP affects about 10.4% of adults and it has been related with a set of factors such as depression, anxiety, healthcare use or early retirement (4). Multiple physical, psychological and social factors have been identified as potential contributors to CLBP and its impact covers several domains of the people's health and life (5,6). For these reasons, a biopsychosocial perspective is required to address the complexity associated with CLBP, as well as to guide clinicians and researchers in their quest for effective treatments.

Currently, conservative interventions, such as physiotherapy modalities, are considered first-line strategies in the management of CLBP (7,8) and a global research effort has been undertaken to analyse their effectiveness. In the field of effectiveness research, the findings have the potential to inform and update the health care provided and, therefore, the proper outcome assessment of the interventions is a critical element (9). Only by evaluating the "right thing" through the "right instrument" will it be possible to accurately quantify, interpret and compare the effectiveness of interventions, as well as to promote better health decisions. Identifying which outcome domains should be evaluated is the first step that aims to ensure that all relevant outcomes of a given intervention in a given population are measured. At this stage, the role of the patient has been reinforced over time.

The growing involvement of the patient in the outcomes measurement of interventions is largely related to the paradigm shift in health care. The patient-centred healthcare paradigm is now dominant and the outcomes measurement is consequently centred on the patient and not only on the perspective of the health professional. The introduction and increasing use of patient-reported outcome measures (PROMs) in clinical practice and research were a natural consequence of this paradigm shift. Additionally, other initiatives, such as the use of measures of global patients' perception of change and minimum important changes (MIC), have been proposed to integrate the patient's view in the assessment and interpretation of the health interventions outcomes. All of these actions contribute to an outcomes measurement that is more integrative of the patient's view, but new challenges have emerged. In particular, the selection of which outcome domains should be measured has not been sufficiently explored considering the patient's view.

Multiple international initiatives and consensus studies have proposed several types of outcome measurement models, suggesting a set of outcome domains that should be measured in studies with patients with low back pain (LBP) or chronic pain (10–12). Pain intensity and functional disability are outcome domains common to all of them (13). Other outcome domains, such as work ability, health-related quality of life and emotional function, are also suggested but not consensual (13). No specific recommendations are known for CLBP or for specific interventions. However, preliminary evidence has pointed to the widespread use of the pain and disability outcome domains to assess the effectiveness of various interventions in patients with CLBP (14). This consensus has advantages when comparing results of different studies, but some criticisms have been raised. CLBP is influenced by and affects a wide range of factors and health domains. Therefore, evaluating only pain and disability can capture a partial part of the expected and potential outcomes of interventions in patient with CLBP (15–17). Additionally, growing evidence holds that pain and disability represent the researchers' perspective and are not fully aligned with the patients' view of the meaningful outcomes for them. Previous studies have suggested that patients with musculoskeletal pain value a broader set of outcome domains in addition to pain intensity and disability (18–20).

Considering the current patient-centred health paradigm, the potential underevaluation of patient-valued outcomes gains particular emphasis and needs to be clarified. Research on this topic is scarce, particularly, in the context of physiotherapy intervention in patients with CLBP. This thesis sought to address this gap, helping to understand the extent to which the outcome domains used in physiotherapy research are sufficient to measure the physiotherapy outcomes as perceived by patients with CLBP. Greater knowledge on this issue can contribute to improving the validity and accuracy of current outcome measurement model, further reinforcing the role of the patient in the process of measuring the outcomes of interventions. Furthermore, a credible and quality outcome measurement contributed to better health choices. Therefore, the results of this thesis may help inform the choices of physiotherapists and other stakeholders about the best interventions to offer and fund to patients with CLBP, contributing to reduce their impact on the individual and societal level.

Accordingly, this thesis was planned targeting five specific objectives:

I. To synthesize the outcome domains, instruments and cut-off values reported in published randomized controlled trials and their compliance with the original Patient-reported Outcome Measurement Information System framework;

II. To cross-culturally adapt the Global Perceived Effect Scale into Portuguese and investigate its psychometric properties in patients with CLBP;
III. To investigate the role of pain and disability changes in explaining the global perception of improvement in patients with CLBP undergoing physiotherapy;
IV. To examine the association between different minimum important change values for pain and disability and a successful response in global perception of improvement in patients with CLBP undergoing physiotherapy;
V. To explore relevant outcome domains for patients with CLBP undergoing physiotherapy.

For these proposals, this thesis is divided in six chapters (beyond this introduction), whose contents are briefly described below.

In Chapter 2, the major concepts and scope of the thesis are presented. First, an overview of epidemiological data and the impact of LBP in Portugal and worldwide is provided. The multidimensional nature and wide impact of CLBP in multiple domains of health and life are then described. To frame the theme of health outcomes measurement, some concepts are briefly described, such as the aims of outcomes measurement, types of outcomes, measurement instruments and outcome measurement models. Then, the importance of the patient's perspective for the evaluation of health outcomes is discussed and framed in the patient-centred healthcare paradigm. A set of actions and methods that aim to reinforce the patient's role in the outcomes measurement are also described. Finally, an overview of outcome measurement in patients with CLBP is presented and discussed critically along with the emerging challenges in this research topic. The preliminary evidence supporting a potential disagreement between the outcome domains currently used in the research and the patients' perspective is highlighted at the end of this chapter.

In Chapter 3, the research question and objectives are described. The rationale underlying each objective, their interrelationships and how they emerge from the limitations of current knowledge are briefly described.

In Chapter 4, the materials and methods used to accomplish each of the objectives are briefly described. Five studies were developed to answer each of the proposed objectives. This chapter is complemented with the next chapter and, for that reason, the materials and methods of each study are summarized only. Some details that were not included in the published or submitted articles are highlighted.

In Chapter 5, the five developed studies are presented in a published or submitted article format. All the findings/ results of the individual studies, as well as the respective discussions and conclusions, are presented in this chapter.

In Chapter 6, a general discussion, including strengths, weaknesses and implications for future studies, is presented. The main results of each study are highlighted and discussed based on current knowledge.

In Chapter 7, the main conclusions of this thesis are presented.

This thesis was based on the following studies:

- Diogo Pires, Eduardo Brazete Cruz, Luís A. Gomes & Carla Nunes; *How Do Physical Therapists Measure Treatment Outcomes in Adults With Chronic Low Back Pain? A Systematic Review*; Physical Therapy, https://doi.org/10.1093/ptj/pzaa030

- Petra Freitas, Diogo Pires, Carla Nunes & Eduardo Brazete Cruz (2019); *Cross-cultural adaptation and psychometric properties of the European Portuguese version of the Global Perceived Effect Scale in patients with chronic low back pain*; Disability and Rehabilitation, https://doi.org/10.1080/09638288.2019.1648568

- Diogo Pires, Eduardo Brazete Cruz, Helena Canhão & Carla Nunes (2020); *The role of pain and disability changes after physiotherapy treatment on global perception of improvement in patients with chronic low back pain*; Musculoskeletal Science and Practice, https://doi.org/10.1016/j.msksp.2020.102139

- Diogo Pires, Eduardo Brazete Cruz, Helena Canhão & Carla Nunes; *Minimal important change values for pain and disability: Which is the best to identify a meaningful response in patients with chronic low back pain?* (Submitted)

- Diogo Pires, Eduardo Brazete Cruz, Daniela Costa & Carla Nunes; *Beyond pain and disability: an explanatory mixed methods study exploring outcomes after physiotherapy intervention in patients with chronic low back pain;* (Submitted)

2. BACKGROUND

2.1. Low back pain: definition, burden and clinical course

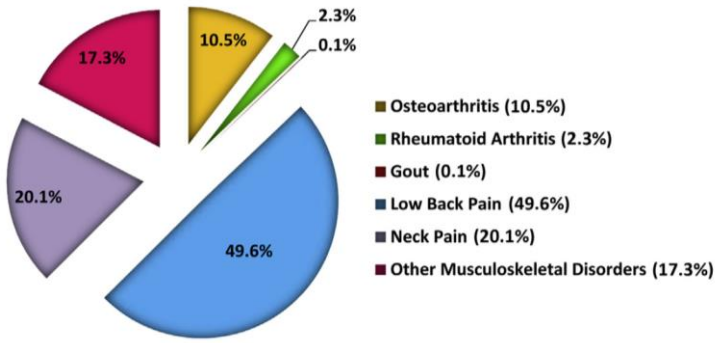
Musculoskeletal conditions are among the most prevalent health conditions worldwide (21,22). Globally, they are the second leading cause of disability and the fourth greatest burden on the health of the population, when both disability and death are considered (21,23). From 1999 to 2010, the disability attributable to musculoskeletal conditions increased by 45%, and is estimated to continue to grow in the coming decades due to population ageing, sedentary lifestyle and obesity (among other factors) (21–23). Musculoskeletal conditions include multiple common conditions such as osteoarthritis, rheumatoid arthritis and neck pain, but LBP has emerged as the leading cause of disability in the world (21,23).

LBP is usually defined as pain, muscle tension or stiffness located above the inferior gluteal folds and below the costal margin, with or without radiated leg pain (24). LBP is an extremely prevalent health problem that affects people of all ages in both developed and developing countries (25,26). The 1-year incidence of the first episode of LBP was estimated to range from 6.3% to 15.4% (26) and 50% to 80% of adults experience at least one acute episode of LBP throughout their lives (27). The global point prevalence of LBP was estimated at 7.3% in 2015 (more than 530 million people), representing an increase of 17.3% compared to data from 2005 (28). Despite contradictory evidence, the prevalence of LBP tends to increase with age and to be higher among females when compared to males (25). In Portugal, LBP is the most prevalent musculoskeletal condition and it is estimated to affect 26.4% (95% CI 23.3-29.5%) of Portuguese adults (29). The estimated prevalence for other common conditions, such as periarticular diseases (15.8%), knee osteoarthritis (12.4%) or osteoporosis (10.2%), was substantially lower than that of LBP (29).

In the 2016 Global Burden of Disease study, and out of the 328 conditions analysed, LBP was the leading cause of years lived with disability (YLDs), contributing 7.2% (6.0–8.3) of the total YLDs (30). When only musculoskeletal conditions are considered, about half of the YLDs were due to LBP (Figure 1) (22). Together with migraine, LBP was in the top 10 causes of YLDs in all 195 analysed countries. The fact that LBP combines high prevalence and greater weight associated to disability helps to explain this ranking. Although the age-standardised YLDs estimated for 2006 and 2016 were

similar, absolute YLD values have increased by 18% due to population growth and ageing (30). According to the same study, LBP was also the primary cause of YLDs in Portugal (30).

Figure 1: Proportions of YLDs for each of the musculoskeletal conditions. Source: Reproduced from March et al. (22) pp. 358.



The clinical course of LBP is initially favourable and most people recover or have low pain intensity within 12 weeks after an acute episode (31,32). A meta-analysis (33 cohorts; 11 166 participants) developed by Costa et al. (2012) showed that pain intensity levels decrease substantially in the first 6 weeks (from 52 points on a 100-point at baseline to 23 points at 6 weeks), but low to moderate levels of pain intensity may persist after 1 year (6 points at 52 weeks) (31). Another systematic review analysing the prognosis of patients with LBP (< 12 weeks of duration), reported that only one-third of patients recovered in the first 3 months and 65% of them still reported pain after 1 year (32). In addition, studies analysing pain trajectories over time have found similar findings. A recent study reported that of the 1585 patients with acute LBP receiving health care, 30% had an incomplete recovery, fluctuating pain or persistent high pain intensity during the 12-week intervention period (33). Furthermore, and even for patients with a complete short-term recovery, the LBP recurrence rate may range from 24% to 70%, depending on the definition adopted and follow-up duration (31,34,35). Despite the lack of consensus, it is estimated that 10% to 20% of patients develop CLBP, presenting continuous or recurrent pain and associated-disability for more than 3 months (36,37).

2.2. Chronic low back pain – Burden, multifactorial nature and management

Although representing a small proportion of cases, most of the costs associated with LBP are attributed to the subgroup of people with CLBP (1). CLBP has a huge

individual and societal impact, mainly because it is the main reason for a loss of work productivity (absenteeism and presenteeism) and is responsible for a high consumption of health resources (1,3,38). The global prevalence of CLBP was estimated to be 4.2% in young adults (24 to 39 years) and 19.6% in adults aged between 20 and 59 years (2). In Portugal, CLBP affects 42% of people with all types of chronic pain (39), presenting an estimated prevalence of 10.4% (95% CI 9.6 to 11.9 %) (4).

A specific cause of CLBP can rarely be identified and affected people are classified as having non-specific CLBP (6,40). There are some plausible structural sources of pain, but both clinical and imaging tests fail to establish a reliable relationship between such sources and the symptoms (41,42). It is estimated that only 10% of people have a specific cause of LBP, such as inflammatory disease, malignancy or fracture, that needs to be identified early and receive specific treatment targeting the cause (6,43,44). Therefore, about 90% of CLBP cases are non-specific and multiple factors, including physical, psychological and social ones, tend to contribute to disabling LBP (6). Biophysical contributors, such as changes in muscle properties or coordination, have been identified in people with persistent LBP when compared to people without pain (45,46). On the other hand, multiple studies have reported the presence of depression, psychological distress or poor self-efficacy in people with CLBP, as well as the mediating role of these psychological factors for high disability (1,47). Likewise, CLBP has been associated with several socio-economic factors such as low educational level, occupational opportunities or annual income (48,49). In Portugal, the latest population-based epidemiological study showed that CLBP was significantly associated with anxiety and depressive symptoms (OR 2.77), an early retirement (OR 1.88), a higher healthcare use (β = 2.65) and a greater disability (β = 0.35) (4).

Although less analysed, important differences between people with acute / subacute LBP and CLBP have been described. According to Brox et al. (2005), people with CLBP have a greater disability ($p<0.001$), higher levels of pain ($p=0.002$), less self-efficacy ($p=0.004$), less life satisfaction ($p<0.001$) and less muscle endurance ($p<0.01$) when compared to those presenting acute LBP (50). Similarly, the study carried out by Grotle et al. (2006) showed that patients with CLBP had significantly higher beliefs of fear-avoidance for work and distress than patients with acute LBP (51). These two subgroups were also significantly different in terms of educational levels (patients with CLBP had fewer years of education) and number of smokers (greater number of smokers in the CLBP group) (51). Significant and more pronounced associations, when compared to LBP in general, between several mental health indicators (depression,

psychosis symptoms, anxiety, sleep disorders, stress sensitivity) and the presence of CLBP have also been described (52).

These set of factors, along with other comorbidities and changes in pain-processing mechanisms, make CLBP particularly complex and its impact on multiple dimensions of the people's health and life is well documented in the literature (4,6,53). A qualitative study conducted by Walker et al. (2006) showed that the perception of loss in multiple domains of life is a core theme in the experience lived by patients with CLBP (54). From the participants' narratives, a set of losses they valued emerged, including losses related to mental and physical abilities, hope, identity, financial, relationships, work or social activities (54). More recently, a metasynthesis of qualitative studies reinforced these findings, describing CLBP (as perceived by patients) as complex, multidimensional and characterized by persistent distressing pain, a feeling of loss, decreased self-esteem, changes in personal, family and professional relationships or strategies of passive coping (avoidance behaviours; medication use) (5).

The recognition of this wide impact and influence of multiple contributors led to the development of assessment and management approaches that target the multiple dimensions of CLBP. Therefore, the biopsychosocial model is now critical to guide the development of more effective interventions (6,24), instead of the biomedical model which focuses only on the physical health dimension and has been showing disappointing results (55,56). Consequently, the management of CLBP has now an emphasis on conservative interventions that involve physical, psychological and social-related components (57). Physiotherapy modalities, such as education and therapeutic exercise, fit this biopsychosocial view and have emerged as first-line strategies in recent clinical practice guidelines (7,8,58).

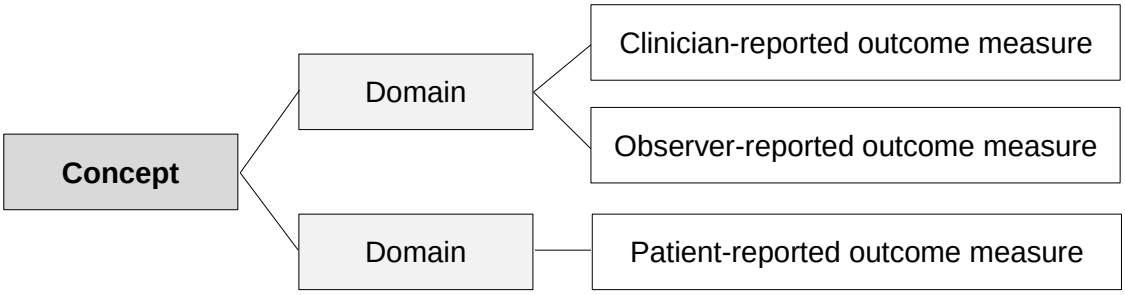
2.3. Measurement of health outcomes – basic concepts

Comparative effectiveness research is the field of research dedicated to the study of the efficacy and effectiveness of health interventions. Its main purpose is to generate and synthesize the evidence that compares the benefits and adverse effects of different interventions in a given health condition in order to assist the various stakeholders to make well-informed decisions that will improve health care (9). A critical element of comparative effectiveness research is to ensure an appropriate outcome measurement, so that the findings reflect reliable and useful evidence about the effectiveness of the interventions (59,60). Therefore, effectiveness studies (e.g.

randomised control trials) are as credible and useful for clinical practice as the appropriateness of their outcomes measurement.

There are a wide variety of health outcomes that may be of interest to healthcare professionals, patients or decision makers. Overall, three categories of outcomes are usually described in the literature: 1) Clinical outcomes representing the perspective of health professionals; 2) Humanistic outcomes that seek to capture the perspective of patients; 3) Economic outcomes that represent the perspective of society and the payer (61). For each outcome category, different concepts and domains can be measured using different measurement methods. Concept has been defined as "the specific goal of measurement (or the *thing* that is to be measured)" and may comprise multiple outcome domains (Figure 2) (62,63). For example, psychological function is a general concept that comprises several domains such as emotional function or cognitive function. In the context of health outcomes, some "concepts" are quite broad and therefore the term "outcome domain" is widely used to represent what should be measured. Regarding the way they are assessed (i.e. measurement methods or instruments used), outcomes can come directly from the patient (patient-reported outcome), a health professional (clinician-reported outcome) or an observer without specific training (observer-reported outcome) (Figure 2) (61).

Figure 2: Schematic representation of concepts, outcome domains and outcome measures



Currently, great emphasis has been given to the development of outcome measurement models (also known as endpoint models) composed of the set of outcome domains that should be considered to measure in a given population or type of intervention. Some examples have been published for musculoskeletal conditions with high burden and prevalence such as LBP (10), neck pain (64) and osteoarthritis (65). These outcome measurement models are then the conceptual basis for developing new instruments or are used to identify the adequate instruments for each outcome domain that integrates the model. A type of outcome measurement models with increasing relevance in the outcomes research are the core outcome sets (COS).

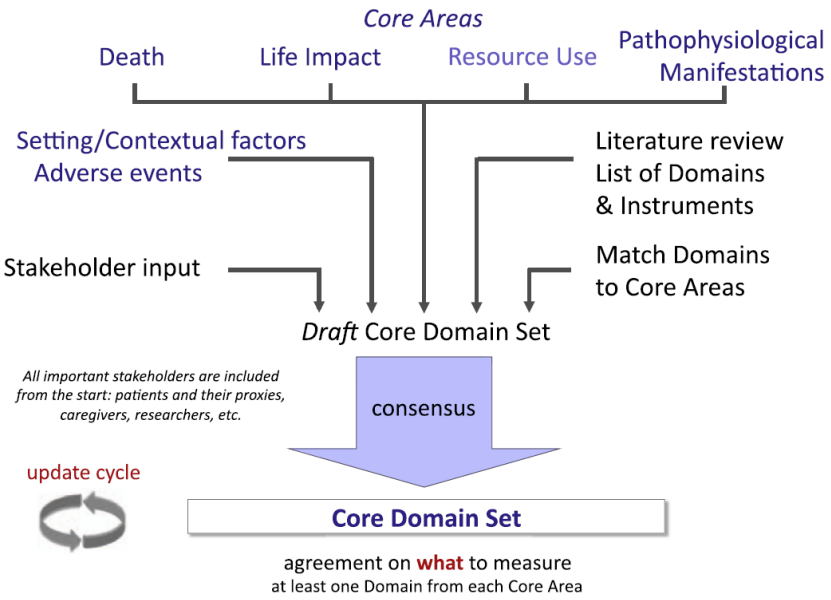
A COS is a minimum set of outcome domains considered critical for clinical decision making and that should be measured and reported in clinical trials for a specific clinical area, intervention or health condition (66,67). This set of domains should be consensual among the different stakeholders to promote its implementation, but it does not imply that other domains cannot be used. For example, specific interventions and research questions may require the assessment of other outcome domains (66,67).

The development of COS has been particularly recommended to avoid three main gaps widely identified in the literature: 1) the use of multiple outcome domains across studies that hampers result comparisons and aggregation in meta-analysis (68,69); 2) the outcome domains are often chosen for convenience and the potential effects of the intervention tend to be under or over-represented (10,64); 3) the outcome domains used in research tend to reflect the researchers' perspective while patient-relevant domains are rarely measured (66,70). For these reasons, COS (or other types of measurement models) should be consensual among relevant stakeholders (e.g. researchers and patients), but should also be comprehensive enough to capture all relevant concepts and outcome domains for a given health condition, intervention and/ or clinical setting (66).

In recent decades, different initiatives have emerged aiming to make researchers aware of the importance of using standardized outcome measurement models and to outline methodological guidelines for their development. The OMERACT (Outcome Measures for Rheumatology Clinical Trials) and the COMET (Core Outcome Measures in Effectiveness Trials) Initiatives are two of the most prominent examples. Both initiatives, along with several researchers, have recommended a stepwise approach to develop a COS. Figure 3 summarizes the process of developing a COS as recommended by OMERACT.

The first step is to describe the scope (or setting) of the COS. An outcome measurement model should be developed for a particular intervention and should consider the specificities of the target population and/ or health condition (66,67,71). For instance, while pain intensity can be considered a primary outcome domain for pharmacological interventions in adults with chronic pain, the same domain may be considered secondary to another population (e.g., elderly) or intervention (e.g., psychological interventions). Although logical, this recommendation is not consensual, as it makes it difficult to compare different interventions for the same population. Ideally, COS should not only integrate common domains that allow comparison between interventions, but also more specific domains, in order to measure the specific effects of an intervention.

Figure 3: Development of a Core Domain Set. Source: Reproduced from Boers et al. (71) pp. 750.



The next step should be to choose a comprehensive and consensual conceptual framework that can be complemented by a literature review to identify domains usually used in clinical trials (66,67,72). This latter method is particularly important in providing a comprehensive overview of the relevant domains for researchers. In turn, following a conceptual framework is essential to ensure the content validity of COS and in which important core areas of health are considered (71–73). There are a number of conceptual frameworks described in health literature. The International Classification of Functioning, Disability and Health (ICF) (74) or the Patient-Reported Outcomes Measurement Information System (PROMIS®) (75) are two examples widely used and accepted by the scientific community. At the same time, input from key stakeholders is critical to identify additional outcome domains, to ensure face and content validity and to detect potential gaps regarding what has been measured in research (66,67,71). Although the stakeholder groups to be included are dependent on the scope of the COS, patient involvement is currently considered a key element in the development of a COS. Cognitive interviews, focus groups or Delphi surveys with patients can be used to achieve this purpose (66,67,71). Lastly, consensus methods can be used to achieve consensus among relevant stakeholders (66,67,71). From a list of outcome domains identified in the previous steps, agreement on the most important domains must be reached (66,67). The usual methods used include expert panel meetings, nominal group techniques, focus groups, individual questionnaires or Delphi surveys. According to a recent systematic review, Delphi survey is the most commonly used method (60).

2.4. Patient-centred health outcome measurement

The measurement of health outcomes has changed substantially over time in order to optimize the way in which intervention outcomes are measured, compared and interpreted. Historically, the effectiveness of health interventions was assessed directly by clinicians and research teams who interpreted the patients' clinical status (62,63). Therefore, clinical outcomes and clinician-reported outcomes have prevailed in the clinical practice and research for most of the 20th century. However, over the past decades, important advances have taken place to reinforce the role of patients in the health outcome measurement (62,76). The patient-centred healthcare paradigm has become dominant, also shifting the way the interventions effectiveness is measured and interpreted. Measuring health outcomes is now centred on the patient rather than the health professional.

An important consequence of this paradigm shift was the increasing inclusion and use of patient-reported outcome and patient-reported outcome measures (PROMs) in clinical practice and research (77). PROMs have been defined as "...a report that comes directly from the patient (i.e., study subject) about the status of a patient's health condition without amendment or interpretation of the patient's response by a clinician or anyone else" (63). Three main arguments have been used to support and promote their use: 1) For some intervention benefits, patients are the only valid source of data (e.g. pain intensity or psychological status); 2) Improvements in clinical outcomes or clinician-reported measures may not be related to improvements perceived by the patients; 3) Assessment of the patients' view provides additional information that can be filtered or lost through a clinician's assessment (62). For these reasons, PROMs are now a vital guide for regulatory agencies (e.g. U.S. Food and Drug Administration), policy makers, researchers and clinicians in providing evidence-informed healthcare. In the United States, the use of PROMs in studies analysing medical devices increased by more than 500% between 2009 and 2015 (78). A similar trend has been observed in Europe, although there are significant differences between the various countries and health research areas regarding the use of PROMs (79).

The use of PROMs was a key piece to put patients at the centre of the health outcomes measurement, but it was not the only one. As described above, the patient's view of what should be measured (i.e. outcome domains) is an indispensable element in the development of outcome measurement models and COS. Similarly, the process of developing a PROM follows a set of steps in which the patient's role is essential

(62). Beyond these aspects related to "what to measure and how to measure", two other methods have emerged to promote the integration of patients' views in the measurement of health outcomes: 1) introduction of the global patients' perception of change as an outcome domain to be measured in effectiveness studies; and 2) use of MIC to analyse the clinical relevance of the benefits of interventions. Both methods are widely accepted and used in all areas of clinical health research. However, they are presented in greater detail below in the context of musculoskeletal and chronic pain conditions.

The measurement of specific outcome domains, such as pain intensity or emotional functioning, can be restrictive and not adequately capture the patients' expectations about the treatment or the meaningfulness to them of any change (improvement or worsening) (12). For this reason, global patient assessments on the perceived benefits of the interventions have been progressively used to reflect both the magnitude of the changes and the individual importance they have for patients (12). This global outcome domain is usually designated as global patients' perception of change[1] and it has been measured using global rating of change scales (GRCS) (80). This type of generic PROMs allows patients to indicate the direction (improvements, no changes or worsening) and the extent of the change from a previous point in time (typically the beginning of the intervention) (80,81). The GRCS consists of just one question about the global change achieved, giving patients the opportunity to summarize in a single answer (Likert scale) all the components of their experience with the treatment they received. The "global" nature of GRCS is a major difference when compared to PROMs developed to measure specific outcome domains, such as disability or sleep quality. Instead, these measures tend to reflect changes in multiple domains considered meaningful by patients (82,83). GRCS should not be seen as a substitute for domain-specific measures, but their contribution to understanding the clinical relevance of the treatment benefits is widely recognized (80,84,85). Due to their simplicity and ease of use, little research has been conducted to assess their psychometric properties (80). While their reliability has been supported by previous studies (86,87), some concerns have been reported regarding their ability to determine true changes over time (validity) (81,87). This issue is related to the retrospective nature of the GRCS, that makes them prone to recall bias. Some authors have argued that GRCS are strongly influenced by health status after intervention, not representing a real change from the baseline (81,87). This limitation can be particularly important in long recall periods and needs to be addressed in future studies. Despite this issue, GRCS are increasingly being used

[1] Also described in the literature by "global patients' perception of improvement" or "global patients' perception of recovery"

as a primary outcome domain in clinical studies, as well as to better understand the specific outcome domains valued by patients with musculoskeletal and chronic pain conditions.

At the same time, the understanding of whether a change in a specific PROM (or outcome domain) was perceived as meaningful by the patient has gained increasing consensus over time. Currently, there is a wide consensus that an essential criterion for success needs to be related to whether the patient perceives the intervention benefits as meaningful or not. Changes in PROMs scores were often interpreted based on clinician and researcher expectations and statistical significance, and a metric that integrated patients' perceptions was needed. To address this issue, the term “minimum important changes” for PROMs was introduced to represent the ‘‘smallest difference in score in the domain of interest which patients perceive as beneficial and which would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient’s management’’ (88). There are several methods to identify the MIC in PROMs, but those that use an external anchor representing the patient's perception (e.g. GRCS) are, by definition, preferable (89). MIC values have been used to classify patients into "responders" or "non-responders", helping clinicians and researchers to interpret the intervention benefits at the individual level and whether they were important to patients. This approach is recommended as a complement to the analysis based on statistical significance, improving not only the interpretation of the research results, but also their translation into clinical practice (e.g., supporting the decision to discharge a patient’) (63,90).

2.5. Outcomes measurement in chronic low back pain and physiotherapy

Recently, several initiatives have emerged to develop outcome measurement models and COS for specific interventions (e.g., VAPAIN initiative for multidisciplinary intervention in patients with chronic pain) (91) or specific musculoskeletal conditions such as shoulder pain (92) or whiplash-associated disorders (93). At this point, specific initiatives for CLBP or physiotherapy intervention in this population are not known. However, several initiatives have been published in recent decades to establish priority outcome domains for patients with LBP or chronic pain in general that are likely to have guided the physiotherapists' choice of outcome domains. The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) for clinical trials of

chronic pain (12) and the one conducted by Chiarotto and collaborators (2015) to patients with non-specific LBP (11) are two widely disseminated examples and are presented in detail below.

Looking at the set of initiatives published since 1998, the domains of pain and disability were common to all, while other outcome domains, such as emotional function, work or quality of life, were not consensual (13). In the most recent initiative developed by Chiarotto et al. (2015), pain and disability reached a broad consensus (>90%) among 117 stakeholders (including clinicians, researchers, experts and patients) as the core outcome domains for assessing the effectiveness of interventions in patients with LBP. Health-related quality of life was also included in the final list of recommended outcome domains, but agreement was less than 75% among participants (11). Probably under the influence of these recommendations, the effectiveness of interventions in patients with CLBP has been largely assessed through the outcome domains of pain intensity and disability (14,94). Systematic data on how the effectiveness of physiotherapy has been measured in patients with CLBP is not known. However, the same trend has been observed when recent systematic reviews assessing the effectiveness of physiotherapy modalities are analysed. A Cochrane review developed by Saragiotto et al. (2016) included 29 high quality trials evaluating the effectiveness of motor control exercises in patients with CLBP. Of the 29 included trials, 28 measured pain intensity and 24 measured disability (95). In contrast, only 7 trials measured health-related quality of life, 4 measured global patients' perception of change and none measured return to work (95). A similar trend can be observed in other systematic reviews in this sample (96,97). Also in the physiotherapy clinical practice, the assessment of disability and pain intensity has prevailed. Östhols et al. (2018) analysed the PROMs used by 1217 Swedish physiotherapists in patients with LBP. Despite the poor use of PROMs by physiotherapists, pain intensity and disability measures were the most frequently reported (98). A recent study developed in Portugal reported identical findings. Of the 123 participants (Portuguese physiotherapists), the vast majority reported always or frequently evaluating the domains of pain intensity (94.3%), return to work and daily activities (89.4%) and disability (85.4%) in patients with LBP (99).

Taken together, this data set seems to provide some evidence that the effectiveness of physiotherapy in patients with CLBP tends to be measured using these two outcome domains. As argued above, the consensus in priority outcome domains is critical to promote the ability to compare and pool results from different clinical trials. However, there is rising evidence that points to the need to consider other outcome domains

beyond pain intensity and disability. At this point, several arguments have been discussed in the recent literature.

Firstly, some authors have argued that pain is a subjective and complex experience influenced by multiple intrinsic and individual factors (15,16). Pain intensity and suffering are influenced by changes in other health factors (such as anxiety, sleep, mood, fear, helplessness) that, for this reason, should also be measured (15,16). On the other hand, the multidimensional nature of CLBP and its impact on a wide variety of physical, psychological and social domains suggest that pain and disability may represent a small part of the potential goals and outcomes of an intervention (10,17). For instance, there is robust evidence showing that domains such as physical capacity (100), kinesiophobia (101,102), pain self-efficacy (101,102), depression (52,103), sleep quality (52) or social functioning (5) are impacted or related to the intervention outcomes in those with CLBP. Overall, outcome measurement models have been developed for LBP in general (10,11) and specific recommendations for outcome assessment in CLBP are not known. However, CLBP has a complexity and an impact that clearly distinguishes it from acute / subacute LBP (50–52). While pain and disability tend to be priority goals and outcome domains in acute/ subacute LBP, the multifactorial nature of CLBP seems to require a more comprehensive outcome assessment framed in a biopsychosocial perspective (17).

Secondly, it has been recommended to follow a conceptual health framework as a starting point for choosing the outcome domains to be measured in clinical studies (72,73). They are particularly relevant to ensure the content validity of the outcome measurement process and which core areas of health are considered (72,73). Thus, the view that it is necessary to measure other outcome domains (besides pain and disability) is reinforced when considering a conceptual framework such as that proposed by the PROMIS® initiative. The original version of the PROMIS® framework includes four core health areas that should be considered when measuring health outcomes: 1) Global health; 2) Physical health (comprising the domains symptoms and function); 3) Mental health (comprising the domains affect, behaviour, and cognition); 4) Social health (comprising the domains relationships and function) (75,104). The disability and pain domains cover only the core area of physical health, which can weaken the validity of the outcome measurement process itself.

Finally, preliminary evidence has reported that pain and disability are researcher-imposed domains and little attention has been given to the patients' perspective on the outcome domains they value (70,105,106). A systematic review published in 2014 showed that relatively few studies (11.6%) developing COS include patients (70).

Another more recent systematic review developed by Jones et al. (2017) reported similar results, describing that of the 26 COS initiatives identified in health literature, only 8 included qualitative approaches with patients (105). For instance, in the most recent initiative to define the priority outcome domains for LBP research, a small number of patients were invited (5.4%, 15 out of 280 participants), and it is not clear that the recommended domains also represent the patients' perspective (11). Even when included, patients represent a small part of the participants, meaning that their view has a small influence on the final decision. Therefore, the clinicians' perspective seems to prevail in the choice and prioritization of the outcome domains, rather than the patient's perspective. Moreover, both quantitative and qualitative studies have suggested that the pain and disability domains are not sufficient to capture the set of intervention outcomes as perceived by patients (20,82,107).

For the purpose of this thesis, the last argument will be particularly discussed because integrating the patients' perspective in the health outcome measurement is a vital requirement in the current health paradigm. The broad impact of CLBP and a conceptual health framework should not be overlooked, but it needs to be framed in the patient's perspective, so that the outcome measurement process does not become unrealistic (too comprehensive) and without clinical applicability. Over the past few decades, a set of actions and methods has been introduced with the aim of valuing the patient's view in the process of measuring health outcomes. The use of PROMs and MIC are important examples already discussed, but new challenges have been identified. In recent years, attention has been paid to the selection of the best PROMs (and MIC), i.e. the question "How to measure?". However, several authors have argued the urgency of adequately answering the question, "What to measure?" (63,108), namely considering the patient's perspective on which domains should be measured. Little research has been developed addressing this issue in people with CLBP or in the context of physiotherapy interventions. However, increasing evidence has been published supporting the discrepancy between the outcome domains used in research and those valued by patients with musculoskeletal pain undergoing other conservative interventions (18,19,109).

2.6. Patients' and researchers' perspective on outcome domains

In 2003, the IMMPACT initiative recommended a set of outcome domains for patients with chronic pain composed of the domains of pain, physical functioning, emotional

functioning, participant ratings of improvement and satisfaction, symptoms and adverse events and participant disposition (e.g. adherence) (12). Twenty-seven researchers and clinicians identified this set of domains. Five years later, the IMMPACT group also conducted a large survey with the same goals, but involving 959 people with chronic pain (110). Although there was some overlap with researchers domains (pain, physical functioning, emotional functioning), patients highlighted other domains such as fatigue, sleep or enjoyment of life (ranked above 8 out of 10, where 10 was extremely important) (110). This study included 524 (54.5%) patients with CLBP and the relevance of the identified outcome domains was consistent across the different conditions.

More recently, a study developed by Beale et al. (2011) compared the domains valued by patients (identified in the IMMPACT study) with those used in 60 recent clinical trials of psychological treatment for chronic pain (18). Surprisingly, only two domains (emotional well-being and physical activities) were assigned comparable relevance by patients and researchers. Other patient-valued domains, such as fatigue, sleep quality or enjoyment of life, were rarely measured in included clinical trials (18). In addition, it was observed that a large number of studies used several outcome measures for the same outcome domain (18). These data seem to reinforce the particular importance that researchers assign to certain outcome domains, while neglecting others potentially relevant to patients. Therefore, the underrepresentation of patient-relevant domains was evident in the studies of psychological treatments, calling into question the validity of the outcome measurement itself.

These studies were conducted using a heterogeneous sample of people with chronic pain and the translation of their findings to a specific sample, such as CLBP, cannot be done accurately. However, they appear to be in line with the results of more recent consensus studies in other specific samples, supporting that patient-relevant outcome domains do not seem to be as important for researchers and clinicians (11,109). This discrepancy has been identified in shoulder pain (111), rheumatoid arthritis (109) or LBP consensus studies (11). Beyond pain and disability, patients with shoulder pain tend to value health-related quality of life and sleep functioning as priority outcome domains (111). Whereas, clinicians and researchers ranked higher the domains of global assessment, psychological functioning, strength and range of motion in relation to patients with shoulder pain (111). In the case of rheumatoid arthritis, the major difference is in the outcome domains of life enjoyment, joint damage and fatigue, which are valued by patients, but are not a part of the current COS or are not regularly measured in clinical studies (109,112). Regarding the 2015 consensus study for LBP

core outcome domains, pain and disability were the priority domains for researchers and health professionals while patients ranked psychological functioning and overall health perception first (11). The small number of included patients was an important limitation in this study.

There is a lack of knowledge on this issue in relation to patient with CLBP and, particularly, in the context of physiotherapy research. One of the few known studies was developed by Gardner et al. (2015), who analysed the alignment between the goals set for the physiotherapy treatment of 20 patients with CLBP and the outcome domains recommended by the IMMPACT initiative (researchers study). The patients' goals fitted mostly in the domains of physical (76%) and emotional functioning (16%), while none of the goals set covered the pain domain (19). In addition to the small sample size, this study analysed the patients' goals before the physiotherapy instead of the outcomes achieved. Pre-intervention goals are likely to be influenced by expectations and therefore may be unrealistic or not achievable through physiotherapy treatment. Despite these limitations, its findings provide preliminary evidence on the potential divergence between the domains valued by patients with CLBP undergoing physiotherapy and the ones valued by physiotherapist and researchers.

This potential disagreement has also been explored using GRCS. Several quantitative studies have analysed the contribution of specific outcome domains to global patients' perception about the benefits of the treatments. Geisser et al. (2010) examined the role of changes in pain intensity, mood, disability, vitality, sleep quality and cognitive function using a sample of patients with fibromyalgia (n=1260) undergoing pharmacological treatment. The study findings showed that the global patients' perception of change was significantly influenced by change in five of the assessed domains (except mood), being pain intensity the most relevant variable ($\beta = 0.40$; $p<0.001$) (82). Together, the changes in the six domains during treatment explain approximately 40% of the variance in the patient's perception of change (82). These study findings support the role of domains not usually evaluated in patients with chronic pain (e.g., sleep or vitality) for the patient's perception of change. However, they also showed that a substantial percentage of variance remains unexplained. A complete accounting of the variance was not expected, but it can be argued that assessing the role of other potential outcome domains may be a relevant step in future studies. More recently, Scott and McCracken (2015) developed a similar study in patients with chronic pain undergoing psychological treatment. They found that perceived changes in mood, pain, and physical, social, and work-related activities explained 64% of the variance in the patients' perception of change (83). In this study, mood and physical

function presented a higher contribution than that observed for changes in pain intensity (83). Both studies seem to reinforce the potential discrepancy between outcome domains valued by the patients and by the researchers, suggesting that outcome assessment in patients with chronic pain should go beyond the pain and disability domains. In addition, they support the possible influence of the type of applied intervention and/ or health condition in the outcome domains that best relate to the patients' perception of change. This may be related to the objectives and mechanisms of action of different interventions, as well as the expectations and characteristics of patients with a specific pain condition.

Another approach used to understand this issue was to analyse the ability of different cut-off values (or response criteria) in specific domains to accurately identify patients who have perceived an overall benefit or a complete recovery (using GRCS). Ward et al. (2014) analysed the association of the five recommended response criteria with meaningful improvements as perceived by patients with rheumatoid arthritis. Despite the high specificity values found for most criteria, sensitivity values were poor (113). These results suggest that a high percentage of patients, who perceived a global improvement, did not meet the response criteria. Thus, response criteria as defined by researchers were particularly important in identifying patients who did not perceive a meaningful improvement, but failed to identify those who achieved it. Another study developed by Kamper et al. (2011) aimed to determine which pain and disability scores most accurately identified patients who perceived a recovery from LBP. Researchers analysed the performance of low pain and disability scores (e.g., 0, 1, 2 on Numeric Rating Pain Scale) that anticipated high associations with the global patient's perception. However, interesting differences were found in the analysis for patients with acute and chronic LBP. High odds ratio values (12.8≤ OR ≤42.5) have been reported for patients with acute LBP, meaning that low levels of pain and disability accurately identified patients who perceive a complete recovery (114). Contrariwise, the odd ratios values (6.3≤ OR ≤23.5) found were substantially lower in patients with CLBP (114). These findings showed that pain and disability changes appear to have a different significance for patients with acute and chronic LBP, and the role of other outcome domains for the global patient's perception may be particularly pertinent in patients with CLBP. The multifactorial nature and wider impact of CLBP in other physical and psychosocial domains, when compared to acute LBP, may help to explain these findings (50–52).

As a whole, research on this topic has supported not only disagreement between patients and researchers on priority outcome domains, but also the inability of

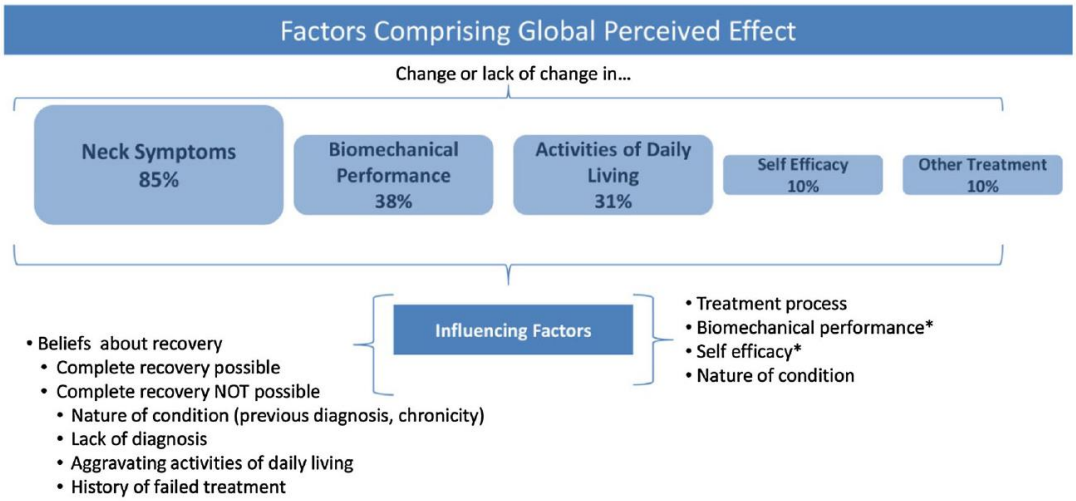
researcher-relevant domains to explain global patients' perception. Consequently, the hypothesis that other unknown or additional patient-relevant outcome domains may help to explain this gap has emerged. First, because in the quantitative studies that analyse this issue, researchers have selected the outcome domains. The same is true for domain prioritization studies where participants (even if patients) make their ratings using a predefined list of domains developed by researchers. Second, there is robust evidence indicating that knowledge about the outcome domains valued by patients and their participation in the process of identifying outcome domain remains unsatisfactory (105,115). Finally, the current outcome measurement[2] does not seem to consider the complexity and the wide impact of CLBP, as well as a set of core areas of health recommended in the health conceptual frameworks. For these reasons, qualitative studies aiming to identify patient-relevant domains and to understand the patients' perspective on the outcome achieved with an intervention have been developed.

Hush et al. (2009) aimed to explore the meaning of the global patient's perception of recovery in 36 patients with LBP managed in primary care. Using a framework analysis approach, the authors reported that the patients' perspective of recovery included a range of outcome domains, such as symptom attenuation, improved function and acceptable quality of life (20). This last domain was particularly comprehensive, encompassing subdomains, such as social factors, sleep or psychological health (20). Another interesting finding was that pain attenuation did not emerge as a reliable indicator of recovery for patients. The authors described that the perception of recovery results from a patients' cognitive appraisal of the impact of symptoms on functional tasks and on multiple domains of quality of life, instead of change in a specific domain (20). Walton et al. (2013) developed another study with similar goals, analysing the perspective of patients with neck pain. The authors used a set of qualitative approach (focus group, written reflections and face-to-face interviews) in order to reach a comprehensive understanding of "recovery". According to the study findings, the construct of "recovery", as described by patients, is multidimensional and mediated by absent or manageable symptoms, physical function, participation in life roles, positive emotions and satisfaction with the sense of self (116). Also for the authors of this study, focusing the measurement of outcomes in patients with neck pain solely on symptoms and levels of disability tends to provide an incomplete and inaccurate view of the effectiveness of interventions (116).

[2] In the context of this thesis, "current outcome measurement models" should be understood as the outcome domains commonly used in research and clinical practice in a given population and / or health condition.

A more recent study developed by Evans et al. (2014) aimed to identify the domains that comprise the global perception of change from the perspective of patients with chronic neck pain. After participating in a randomized clinical trial assessing the effectiveness of physiotherapy (exercise and manual therapy), patients took part in semi-structured interviews, asking the meaning of global perception of change. Five domains emerged from qualitative analyses: symptoms, biomechanical performance, activities of daily life, self-efficacy and need for other treatment (Figure 4) (107). These findings are in line with those described in previous studies, but they are of particular relevance as they emerge from patients undergoing physiotherapy who share many of the characteristics of patients with CLBP. In addition, this study explored the contributing factors to the global perception of change. An identified factor of particular relevance was that patients with chronic neck pain did not believe in their complete recovery due to the irreversible nature of their health condition (107). With this belief in mind, it is understandable that patients may have expectations and value outcomes domains that range beyond pain resolution. As reported in other studies, the impact of condition and pain on other domains of life and health may be more important for patients with chronic pain than the reduction or elimination of pain intensity itself.

Figure 4: Factors comprising or contributing to global perception of change in patients with chronic neck pain. Source: Reproduced from Evans et al. (107) pp. 894.



To data, consistent evidence from qualitative studies has been published supporting the relevance given by patients with musculoskeletal pain to multiple outcome domains. Pain and disability emerged as relevant domains in most studies, but they were only 2 out of several other identified domains. From this type of studies, it is not possible to rank the various domains by importance and so the only conclusion that can be drawn is that patients value a wide range of domains beyond pain and disability. This view appears to be in line with the biopsychosocial model and the well-

documented impact on multiple health domains of musculoskeletal pain conditions. In contrast, researchers tend to use a small number of outcome domains to assess the effectiveness of interventions, in particular by using pain and disability domains. Not surprisingly, several authors have warned of the consequent lack of validity of the measurement of the effectiveness of health interventions (10,64,65). If the current measurement model does not accurately represent the perspective of patients, then some of the potential benefits or adverse effects of interventions may be underestimated. The same conclusion can be drawn when a health conceptual framework is considered. The major threat is that partial coverage of the intervention effectiveness may become regular and acceptable, affecting the use of appropriated measures, the outcomes valued (and funded) and the interventions provided. However, it is important to clarify that qualitative and quantitative studies analysing this issue provide evidence about the perceived benefits, rather than the specific outcomes of a particular intervention. Particularly, perceived outcomes coming directly from patients tend to be influenced by multiple contextual factors (e.g. previous experiences, beliefs or expectations) and other sources of bias (e.g. natural course of the disease) (117). For these reasons, a set of steps and studies using different methods (including experimental studies) are needed to develop an outcome measurement model for a given intervention. This thesis addresses the early stages of this process, focusing on perceived outcomes by patients, rather than on the specific outcomes that can be attributed to physiotherapy interventions in patients with CLBP.

In summary, CLBP is a condition with high individual and societal impact that has required an increasing research effort to develop effective interventions. Physiotherapy modalities have emerged as first-line strategies, but the way their outcomes are measured has recently been questioned. Preliminary evidence has pointed to an incomplete assessment of the potential outcomes of physiotherapy, namely due to the underestimation of patient-relevant outcome domains. In addition, the multifactorial nature of CLBP and its recognized impact on multiple domains of health and life do not seem to be under consideration either. While researcher-relevant domains such as pain and disability have been widely used in clinical studies, there is a growing consensus that other domains are needed to capture the set of outcomes perceived by patients. These findings come from other interventions and health conditions and there is little knowledge about CLBP and physiotherapy context. Furthermore, the various studies addressing this issue have focused on the goals or outcomes expected by patients before the interventions, instead of the outcomes achieved from a specific applied intervention. Research addressing this issue is needed to promote the use of a

valid and comprehensive outcome measurement model in physiotherapy clinical practice and research in patients with CLBP.

3. AIMS

The main purpose of this thesis was to analyse the relationship between outcome domains usually used in research and the patients' perception of physiotherapy outcomes. In order to achieve it, we intend to answer the following research question:

- Do outcome domains used in physiotherapy research capture meaningful improvements as perceived by patients with CLBP undergoing physiotherapy treatment?

Although the domains of pain and disability are often used in research, there is a scarcity of knowledge regarding how the effectiveness of physiotherapy has been measured in patients with CLBP. Currently, existing knowledge on this topic comes from other samples or interventions, and its generalization to physiotherapy research in patients with CLBP cannot be performed accurately. Simultaneously, little is known about whether the most used outcome domains cover the core areas of an internationally accepted conceptual framework, such as that proposed by the PROMIS® initiative. Therefore, these issues require a systematic analysis of the outcome domains used in physiotherapy research, as well as of their alignment with a conceptual framework (Objective I).

Based on this overview, a better understanding of the alignment between the outcome domains used in research and the patients' view of physiotherapy outcomes is needed. Preliminary evidence has consistently suggested that commonly used outcome domains largely reflect the researchers' view and they may not fully capture what is relevant to patients. To analyse this hypothesis, it is also required to culturally adapt and investigate the psychometric properties of an outcome measure that represents the patients' view of the benefits achieved with treatment (Objective II). This knowledge may clarify the extent to which the researcher-valued outcome domains are sufficient to assess the physiotherapy benefits considering the patients' perspective (Objective III & IV).

Lastly, previous studies have described that patient-valued outcome domains tend to differ between health conditions and applied interventions. At this point, several studies identified multiple outcome domains directly from patients, but those valued by patients with CLBP undergoing physiotherapy remain unknown. Therefore, exploring the view of

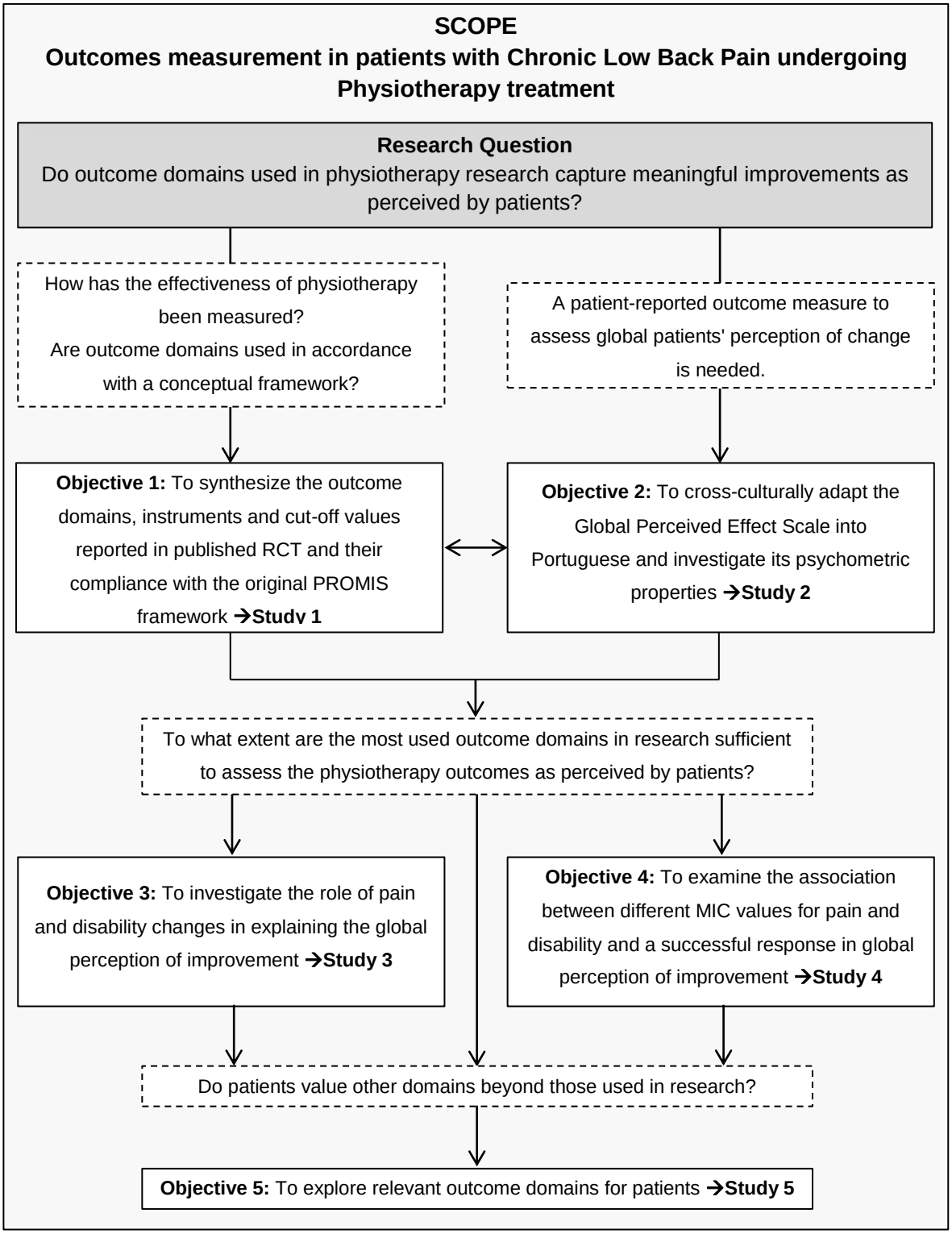
the patients with CLBP on perceived outcomes of physiotherapy is critical to understand the potential disagreement between domains valued by researchers/ clinicians and patients, as well as to inform the potential update of the current outcome measurement models (Objective V).

Accordingly, this thesis includes five research studies with the following objectives:

I. To synthesize the outcome domains, instruments and cut-off values reported in published randomized controlled trials and their compliance with the original Patient-reported Outcome Measurement Information System framework;
II. To cross-culturally adapt the Global Perceived Effect Scale into Portuguese and investigate its psychometric properties in patients with CLBP;
III. To investigate the role of pain and disability changes in explaining the global perception of improvement in patients with CLBP undergoing physiotherapy;
IV. To examine the association between different minimum important change values for pain and disability and a successful response in global perception of improvement in patients with CLBP undergoing physiotherapy;
V. To explore relevant outcome domains for patients with CLBP undergoing physiotherapy.

Together, all the studies contributed to answering our research question. The relationships between the various studies and the research question, as well as the expected findings, are shown in Figure 5. This thesis may contribute to reinforcing the role of the patient in the measurement of physiotherapy effectiveness in CLBP.

Figure 5: Schematic representation of the scope, question and objectives of the research.



Legend: RCT – Randomised controlled trials; PROMIS® - Patient-reported outcomes measurement information system; MIC – Minimum important change

4. MATERIALS AND METHODS

To accomplish the objectives of this thesis, five studies were conducted. Table 1 summarizes the relationship between the objectives, studies and methods used. The materials and methods used are described in detail in the next section (chapter 5) as an integral part of published or submitted articles. A general description of the methods for each study, as well as some noteworthy details that were not presented in the individual articles are provided below.

Table 1: Objectives and methods of the different studies

Objectives		Studies and Methods
		Study 1
I.	To synthesize the outcome domains, instruments and cut-off values reported in published randomized controlled trials and their compliance with the original PROMIS framework;	Design Systematic Review Databases MEDLINE; Cochrane Library; EMBASE; Physiotherapy Evidence Database, World Health Organization's International Clinical Trials Registry Platform; US National Institutes of Health Type of studies Randomised control trials published in the previous 10 years Interventions Physiotherapy treatments Comparison and Outcomes No restrictions
		Study 2
II.	To cross-culturally adapt the Global Perceived Effect Scale into Portuguese and investigate its psychometric properties in patients with CLBP;	Design Longitudinal design with two phases: 1) A translation and cultural adaptation phase; 2) A validation phase to analyse the psychometric properties Analysis Intraclass Correlation Coefficient; Spearman correlation coefficient; Linear regression models; Receiver operating characteristics method
		Study 3
III.	To investigate the role of pain and disability changes in explaining the global perception of improvement in patients with CLBP undergoing physiotherapy;	Design Prospective cohort study Variables Independent variables - Pain intensity; Disability; Dependent variable - Global patients' perception of improvement Intervention Physiotherapy usual care Analysis Pearson correlation coefficient; Linear regression models

		Study 4
IV.	To examine the association between different minimum important change values for pain and disability and a successful response in global perception of improvement in patients with CLBP undergoing physiotherapy;	Design Prospective cohort study Variables Independent variables - Pain intensity; Disability; Dependent variable - Global patients' perception of improvement Intervention Physiotherapy usual care Analysis Logistic regression models
		Study 5
V.	To explore relevant outcome domains for patients with CLBP undergoing physiotherapy.	Design Mixed-methods design including a before-and-after treatment design and focus group discussions. Variables Pain intensity; Disability; Global patients' perception of improvements Intervention Physiotherapy usual care Analysis Responder analysis (quantitative); Inductive thematic analysis (qualitative)

Objective I - Systematic Review

To address the first objective of this thesis, a systematic review of the literature was conducted. The protocol of this study was previously registered in the international prospective register of systematic reviews (PROSPERO; ID: CRD42018093985). Recommendations for systematic reviews of interventions developed by Cochrane Back and Neck group (2015) were considered in its design and development (118).

The criteria for considering studies for this systematic review were defined in advance according to the PICO (Participants, Interventions, Comparisons and Outcomes) approach (118). Broad criteria and definitions for each component were adopted in order to integrate a wide range of primary studies representative of global research in this field and its potential heterogeneity. However, the age restriction of the participants was established due to marked differences in the characteristics of children / young people, adults and the elderly that tend to influence the type of outcomes used in research. In addition, only recent randomized control trials were considered to obtain a current view in the field of comparative effectiveness research. In brief, randomized control trials (published in the last 10 years) comparing any physiotherapy intervention (applied by physiotherapists) to any other intervention in adults with nonspecific CLBP (aged 18 to 70), and that analysed any type of outcomes were included.

To identity published, unpublished and ongoing studies, six electronic databases (MEDLINE; the Cochrane Library; EMBASE; Physiotherapy Evidence Database, World Health Organization's International Clinical Trials Registry Platform; and US National Institutes of Health) were systematically searched from January 2008 until January 2018. Additional studies were searched in the reference lists of recent systematic reviews and other related studies. The search strategy was comprehensive using relevant terms and keywords based on the inclusion criteria and following the recommendations of the Cochrane Back and Neck group (118). Priority was given to the sensitivity of the search strategy rather than the specificity in order to ensure that all relevant studies were included. Due to the long duration of the process of primary studies selection and data extraction, the search was updated in April 2019.

Study selection and data extraction were conducted independently by two researchers. Disagreements were resolved through discussion between the two researchers or through a third researcher. Primary studies were included only when all criteria were clearly identified in the full-text. In case of uncertainty or unclear description, the authors were contacted via e-mail for further information. The risk of bias in included trials was not assessed. The objective was to ensure a comprehensive evaluation of the outcome domains, instruments and cut-off/ MIC values used in studies assessing the effectiveness of physiotherapy regardless of their methodological quality. The identified outcome domains and instruments were mapped to the four core health areas and seven domains of the PROMIS® framework. First, the PROMIS® framework was chosen due to its timeliness and the quality of its development process, which was anchored in the health definition of the World Health Organization and had input from multiple stakeholders such as patients (75,104). Second, its appropriateness in analysing the scope and content validity of outcome measurement models has been suggested recently (72,73).

Objective II, III & IV – Longitudinal studies

To address the second, third and fourth objectives of this thesis, two data collection processes were conducted using longitudinal designs. The common aspects are described first, while other specific details are presented with reference to each of the three objectives/ studies. All studies were previously analysed and approved by the Ethics Committee of the School of Health Care, Institute Polytechnic of Setúbal, and Local Health Unit, Castelo Branco.

Participants, settings and recruitment: Consecutive patients with nonspecific LBP (aged 18 to 65 years) lasting at least 12 weeks were recruited from the waiting list of different public and private physiotherapy settings in Portugal. Nonspecific LBP was defined as "tension, soreness and/or stiffness in the lower back region for which it is not possible to identify a specific cause of the pain; several structures in the back, including joints, discs and connective tissues, may contribute to symptoms" (119). Potential participants with signs of specific conditions (6) (inflammatory disorder, fracture, radicular syndrome), pregnancy, or history of back surgery or conservative treatment in the previous 12 and 3 months, respectively, were excluded. At least one physiotherapist from each physiotherapy setting collaborated in the recruitment process, checking the eligibility of potential participants and applying physiotherapy intervention/ treatment. All adopted procedures, eligibility criteria and definitions were included in a standardized protocol that was followed by local physiotherapists. After the eligibility criteria had been confirmed, the participants received verbal and written information about the objectives and details of each study. For those who agreed to participate, the confidentiality of the data and anonymity was clarified before they signed the informed consent. All records and instruments filled out by the participants were anonymized using an individual numeric code. This code was then used to anonymize and introduce the participants' data into a common database. The individual data were introduced in a standardized manner following a previously developed codebook.

Interventions: In none of the three studies, the applied intervention was under analysis. The type of physiotherapy modalities applied and other characteristics of the intervention were the responsibility of the local physiotherapist, in order to reflect the common variability of usual practice. This option has been recommended when it is intended to translate the results in an intervention that may include several treatment modalities (e.g. physiotherapy) instead of specific treatments (e.g. therapeutic exercise). It is assumed that this heterogeneity washes out specific treatment modifier effects (120). However, general definitions of physiotherapy treatments (e.g. manual therapy techniques, therapeutic exercise, electrotherapy, therapeutic education) were provided in order to avoid the application of treatments outside the scope of physiotherapy.

Baseline variables and outcome measures: At baseline, a set of sociodemographic and clinical variables were collected through a standardized self-reported questionnaire. This questionnaire was developed in accordance with international guidelines, namely those proposed by *NIH Task Force on Research Standards for Chronic Low Back Pain* (121). In addition, three PROMs were used to measure the average pain intensity on

the day of assessment (Numeric Pain Rating Scale - NPRS), functional disability (Portuguese version of Quebec Back Pain Disability Scale – QBPDS-PT) and global patients' perception of change (Portuguese version of Global Perceived Effect Scale – GPES-PT). Regarding the instruments to measure pain intensity and functional disability, there is no clear consensus on which should be used in patients with LBP (122,123). Thus, the choice was for simpler instruments for patients and whose psychometric properties have been analysed in Portuguese patients with CLBP. The European Portuguese version of the GPES was not available and, for this reason, its translation, cross-cultural adaptation and analysis of psychometric properties were performed in study 2. Although there are several PROMs described to assess global patients' perception of change, the GPES was chosen because it presents a set of advantages in relation to the others, namely: the term "back" is mentioned in the anchor question; its equal number of points for worsening and improvement (-5 to +5); its 11-point format ensures a better compromise between discriminative capacity, reliability, and patient preferences (80,124).

Data audit: During the second data collection process (study 3 and 4), an audit was performed on the data previously collected with the aim of: 1) Comparing the original data (filled by the participants) with those entered in the database by local physiotherapists; 2) Analysing any problems in codification/anonymization of questionnaire booklets; 3) Analysing the number and management of missing items. Thirty-six questionnaire booklets (10% of the total at that time) were randomly chosen and analysed according to the previous points. A small percentage (1.85%) of wrong data entries in the database were identified and corrected. The percentage of unanswered items in the PROMs used was residual (0.38%). The management of missing items and the introduction of global scores into the database by local physiotherapists was correct in all identified cases. A report including the description of the audit process, the results and the recommendations was produced and shared by the collaborating physiotherapists.

- Specific methods used in Study 2

To achieve objective II, a longitudinal study was conducted with specific methodological details and two distinct phases: 1) translation and cross-cultural adaptation of the GPES; and 2) assessment of its psychometric properties in patients with CLBP undergoing physiotherapy treatment.

Phase 1 was conducted following a stepwise approach widely accepted and described in published guidelines (125). At this phase, it is important to highlight two options that differ from the procedures usually adopted in similar studies. First, patients were given an additional role during the field test, giving them the opportunity to choose alternative questions and format responses to those in the original GPES version. Then, current recommendations are to test the pre-final version of the instrument on 30 to 40 patients (125). These recommendations were designed for multi-item instruments so that, since the GPES has only one question, the researchers considered it appropriate to use 10 patients at this stage.

In Phase 2, the test-retest reliability, validity, responsiveness and interpretability of the Portuguese version of the GPES were analysed. The methods and options adopted to test each psychometric property are summarized below. Additional details to those described in article 2 are highlighted.

- Test-retest reliability: The GPES-PT was filled out at the initial assessment and 48 hours later. No treatment was provided between the two assessment moments. This time period was purposely short in order to prevent changes in the construct under measurement (126). However, pain intensity was also measured in the second moment to identify patients in a stable condition (126). Test-retest reliability was assessed for this subgroup of stable patients (when pain intensity remained unchanged or improved less than 30%) by using Intraclass Correlation Coefficient.
- Validity: The Patient Global Improvement Change Scale (127) was used to assess the convergent validity of the GPES-PT, because both instruments assess the same construct. The Spearman correlation coefficient was used to assess the relationship between the scores of both instruments after 6 weeks of physiotherapy intervention. Due to the transitional nature of the GPES-PT, the contribution of baseline scores in specific domains (pain and disability) to GPES-PT scores was analysed as a requirement to ensure its validity. This requirement was analysed following a set of steps proposed by Guyatt et al. (2002) (128).
- Responsiveness and Interpretability: The responsiveness of GPES-PT was analysed in three steps: 1) the relationship between change scores of the Patient Global Improvement Change Scale and GPES-PT was evaluated using the Spearman correlation coefficient; 2) the relationship between the post-intervention GPES-PT scores and the changes score of the pain and disability measures was evaluated using the Spearman correlation coefficient; 3) the

discriminative ability of the GPES was analysed using the receiver operating characteristics (ROC) method and interpreted through the area under the ROC curve (AUC). The Patient Global Improvement Change Scale (scores ≥ 5) and NPRS (improvements ≥ 30%) were used as the external anchors to analyse the discriminative ability and to compute MIC of the GPES-PT.

In this study, all participants underwent a programme of usual care in physiotherapy for 6 weeks. The reasons for not controlling the applied intervention were presented above while its duration was related to the expected time to obtain changes in the health status of patients with CLBP. Ensuring that the intervention is long enough for changes in pain and disability to occur is particularly important for analysing the responsiveness of an outcome measure. Therefore, the intervention lasted 6 weeks because it is the time moment when the main improvements in patients with LBP are expected (129,130) and because it is most likely to find true variability in scores in this clinical retest period (131).

- Specific methods used in Study 3

To achieve objective III, a prospective cohort study was conducted in patients with CLBP receiving usual care in physiotherapy. Participants were assessed at baseline, at the end of 8 weeks of physiotherapy treatment and 12 weeks after the beginning of the treatment. A minimum sample of 156 participants was required considering the number of variables under analysis and a potential loss of 20% of participants during the study. Ten sociodemographic and clinical variables were assessed at the baseline: age, gender, body mass index, educational level, working status, pain duration, irradiated pain, medication use, pain intensity and functional disability. The assessment of pain intensity (NPRS) and functional disability (QBPDS-PT) was repeated at 8 and 12 weeks along with the global patient's perception of change (GPES-PT).

Absolute and percentage changes in pain intensity and disability scores were calculated at 8 and 12 weeks of follow-up. Based on the findings of study 1 (systematic review), pain intensity and disability changes were defined as the only independent variables under analysis. First, the association between the pain intensity and disability changes and the GPES-PT scores were analysed using the Pearson correlation coefficient. Secondly, linear regression models were used to analyse the association of pain intensity and disability (absolute and percentage) changes (independent variable) in relation to the GPES-PT scores (dependent variable). All sociodemographic

and clinical variables with a value of p≤0.2 were entered in multivariate models as covariates. A stepwise approach was used to investigate the contribution of independent variables, alone and together, to the GPES-PT scores at 8 and 12 weeks. For this purpose, the explained variance (R^2) and the relative importance of predictors (132) were collected at each step of analysis.

- Specific methods used in Study 4

Regarding objective IV, the analysis performed was based on the database originally obtained for study 3. From the changes in pain intensity and disability (absolute and percentage), patients who reached a set of cut-off values were identified in the database. The cut-off values used in the analysis were: reductions of 2 points, 30% and 50% improvement in pain intensity (NRPS); and reductions of 20 points and 30% in disability (QBPDS-PT). These cut-off values were identified from the findings of study 1 (the cut-off values most used in physiotherapy trials) and those recommended by international consensus groups (133–135). Additionally, two composite criteria, including pain and disability together, were used: a simultaneous reduction of 2 points in pain intensity and 20 points in disability; and a simultaneous 30% reduction in pain intensity and disability. The association of each of these cut-off values and composite criteria (independent variable) with a successful response as perceived by patients (dependent variable) was analyzed using logistic regression models. A score equal to or greater than 3 on the GPES-PT was defined as a successful response (value that derived from the findings of study 2). The discrimination power (through area under ROC curve), specificity, sensitivity and predictive values for each cut-off values and composite criteria were computed. This study was developed to understand the clinical relevance of the different cut-off values usually used and recommended. For this reason, an analysis that simulated the “real world” was performed, not introducing the clinical and sociodemographic variables on the logistic regression models (crude OR) and using only the post-intervention data (8 weeks).

Objective 5 – Mixed-methods study

An explanatory mixed methods design, composed of a quantitative phase (a before-and-after treatment design) followed by a qualitative phase (focus group discussions),

was used (136). This design was chosen expecting that qualitative strand improves the understanding of the initial quantitative findings and, in the context of this thesis, the findings of studies 3 and 4. For these reasons, greater emphasis was placed on the qualitative phase.

In order to ensure a heterogeneous sample, patients with CLBP were recruited for convenience at four physiotherapy settings at different levels of health care. A chronic pain medical department of a public hospital, a physiotherapy outpatient clinic and two primary care centres were selected in a specific region of Portugal (Castelo Branco). The eligibility criteria and the process of identification and recruitment were similar to the studies previously described. Patients who agreed to participate in the study received usual care in physiotherapy under the responsibility of 5 local physiotherapists. Clinical and demographic data, pain intensity (NPRS) and disability (QBPDS-PT) were collected at baseline. After 8 weeks of treatment (or earlier if they were discharged), pain intensity and disability were assessed along with global patient perception of change (GPES-PT). An responder analysis (137) was performed to identify participants who achieved MIC in the assessed outcome domains. Only participants who reported a global meaningful improvement in GPES-PT (score of ≥3) participate in focus group discussions. This option aimed to avoid misperception between expectations and perceived outcomes for those who did not report a successful response in GPES-PT. Three focus groups were conducted by two researchers without previous contact with the participants. Focus group discussions were guided by a semi-structured interview schedule developed for that purpose. Discussions were video and audio recorded with the permission of the participants and later anonymized and transcribed verbatim. Inductive thematic analysis was used to analyse the qualitative data and identify the emergent themes and subthemes, following the six phases described by Braun and Clarke (2006): (1) familiarization with the data, reading the transcription and listening to audio-recorded data several times; (2) coding, generating codes for relevant features of the data considering the research question; (3) searching for themes, collating codes into themes and sub-themes based on similarities in the data; (4) reviewing themes, checking if the themes work with coded extracts and the entire data set; (5) defining and naming themes, identifying the "essence" of what each theme is about; (6) writing up, providing relevant data extracts which demonstrate the prevalence of each theme/sub-theme. Although the analysis was carried out by the main researcher, all phases were monitored and findings were reviewed and discussed with the other researchers.

5. RESULTS / STUDIES

5.1. Study 1 - How do physical therapists measure treatment outcomes in adults with chronic low back pain? A systematic review

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How Do Physical *Therapists Measure Treatment Outcomes in Adults With Chronic Low Back Pain? A Systematic Review*
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How Do Physical Therapists Measure Treatment Outcomes in Adults With Chronic Low Back Pain? A Systematic Review

Abstract

Background: There is an increasing recognition of the importance of using a conceptual framework covering the full range of relevant health domains and outcome measures addressed by physical therapy modalities in patients with chronic low back pain (CLBP). However, little is known about what outcome domains have been measured and through what measures in physical therapy research.

Purpose: The purpose of this review was to synthesize the outcome domains, instruments, and cutoff values reported in published randomized controlled trials and their compliance with the original Patient-Reported Outcomes Measurement Information System (PROMIS) framework.

Data sources: The EMBASE, Medline, Cochrane Library, and Physiotherapy Evidence Database electronic databases were systematically searched from January 2008 to April 2019.

Study selection: In this review, randomized controlled trials that compared physical therapy with any other intervention for adults with CLBP were included.

Data extraction: Study characteristics, outcome domains, instruments, and cutoff values were extracted by 2 reviewers. The PROMIS framework was used for domain categorization.

Data synthesis: One hundred ninety-five studies were included, with 52 outcome domains and 45 cutoff values identified from 182 instruments reported. Only 14 of 195 studies assessed all PROMIS health core areas, while the PROMIS physical health core area was assessed in all included studies. Pain intensity and disability were the most frequently used domains.

Limitations: Only studies for which full texts were available in English were included.

Conclusions: This review identified a poor overlap between the PROMIS framework and outcome domains used to define the effectiveness of physical therapy in adults with CLBP. This finding suggests that other potential benefits resulting from physical therapy modalities are not being measured. Furthermore, a large diversity in the outcome domains and instruments was found.

Introduction

Low back pain is a common health problem affecting people of all ages in both developed and developing countries.[1,2] This condition is currently considered the leading worldwide cause of disability and its burden has grown in recent decades.[3] Approximately 5% to 10% of patients experiencing a low back pain episode will develop nonspecific chronic low back pain (CLBP), and its estimated prevalence ranges from 3.9% to 20.3% in adult populations.[4] CLBP is an important cause of loss of productivity (absenteeism and work disability), has a high cost of treatment and is the main reason people seek out health care professionals.[5–7] The high impact for individuals as well as the association with lower quality of life and psychological symptoms have been widely reported in the literature.[5,8]

Recent clinical practice guidelines for CLBP9[10] support the use of physical therapy modalities, such as manual therapy, therapeutic exercise, or education. These modalities address the most common patient' outcome goals such as pain and disability.[11] However, given the multifactorial nature of CLBP and the impact of chronic pain on multiple health-related domains,[12,13] recent recommendations to consider other outcome domains have emerged.[13–15] Additionally, a growing number of studies exploring the perspective of patients and other stakeholders have reinforced the need to consider additional domains, such as sleep, coping skills or emotional well-being.[13,16,17] To address this challenge, the need to consider a conceptual framework for selecting outcome domains has been widely recognized.[18,19] Following a conceptual framework may ensure a comprehensive assessment of the outcomes while promoting the standardized use of domains between studies and interventions.

A recent example is the conceptual framework proposed by the Patient-Reported Outcomes Measurement Information System (PROMIS) initiative. The first version of the PROMIS framework was based on the definition of health by the World Health Organization and included 4 health core areas: global health, physical health (comprising the domains symptoms and function), mental health (comprising the domains affect, behavior, and cognition), and social health (comprising the domains relationships and function).[20,21] This initiative followed robust and well documented methods, and had in consideration the perspective of key stakeholders such as patients.[21] For these reasons, its appropriateness in choosing the most important outcome domains for clinical research has been suggested.[18,19]

Within the context of physical therapy and CLBP, little research has been published on this topic and a number of questions require further exploration. First, no systematic analysis exists regarding how the effectiveness of physical therapy has been assessed in patients with CLBP. Second, little is known about the alignment between the domains used and a conceptual framework such as the PROMIS initiative. The aim of this systematic review was to identify the outcome domains, instruments and cutoff values reported in published randomized controlled trials of physical therapist interventions for adults with CLBP and to assess their compliance with the PROMIS framework.

Methods

This systematic review was registered in the International Prospective Register of Systematic Reviews (PROSPERO; ID: CRD42018093985).

- Data Sources and Searches

A comprehensive electronic search to identify relevant studies was conducted in January 2018 in the following databases: MEDLINE, Cochrane Library, EMBASE, and Physiotherapy Evidence Database. A search update was conducted in April 2019. The search strategies used can be found in Appendix 1. An academic librarian supported the definition of the search strategy and electronic search. To identify both unpublished and ongoing trials, a search in the database of the World Health Organization's International Clinical Trials Registry Platform and the US National Institutes of Health (ClinicalTrials.gov) was performed. Additionally, the reference lists of recent reviews and the included trials were reviewed to identify other relevant publications.

- Study Selection

Two authors (D.P. and L.A.G.) independently screened all the titles and abstracts for possible inclusion according to the predefined eligibility criteria. All potentially relevant studies were subsequently assessed by full-text analysis. If any of these studies did not present enough data to make a decision, the authors were contacted for clarification by e-mail (2 e-mails in a 3-week period). If no response was received, the studies were excluded. Disagreements between the 2 reviewers were resolved through discussion

with a third review author (E.B.C.). All studies that fulfilled the following criteria were included in this systematic review.

Types of studies

Only randomized controlled trials were included. Studies were eligible if they were published in English between January 2008 and January 2018. Because a search update was conducted in April 2019, studies published to this date were considered.

Participants

Studies including young or elderly tend to consider specific characteristics of these groups in the choice of instruments and outcome domains. For this reason, only studies including adults with nonspecific CLBP (>12 weeks, with or without leg pain), were considered for this review. Based on recent literature,[22] the age range to define adults (between 18 and 70 years) was obtained by consensus among the research team. Studies that included patients with specific conditions such as spinal stenosis, cancer, inflammatory disorders, vertebral fracture, cauda equina syndrome or radicular pain[23] were excluded. In the case of studies with mixed populations (type and duration of back pain), these were included only if separate analysis for different groups was provided.

Interventions

Studies comparing any physical therapist intervention with placebo, no treatment/waiting lists or other intervention were included. Physical therapist interventions included manual therapy, therapeutic exercise, physical modalities, electrotherapy modalities and education. The detailed intervention definitions used are presented in Appendix 2. Studies were included if physical therapy modalities were applied alone or in combination with others, as well as the comparison of 2 different modalities.

Outcomes

All types of outcomes/domains were considered.

- Quality Assessment

In this review, the methodological quality of the included studies was not appraised. First, the methodological issues are not related to the outcome domains and instruments selected by the researchers. Second, a critical appraisal of the quality would exclude a substantial number of studies and prevent the comprehensive identification of all domains and instruments used in effectiveness studies of physical therapy.

- Data Extraction

Two reviewers (D.P. and L.A.G.) independently extracted the data from each included study using a standardized table developed specifically for this systematic review. The data extracted included: study characteristics (author; year; title; country); participants (gender; number; age) intervention characteristics (type and duration of intervention); and outcome characteristics (instrument used; outcome domains; time interval incorporated in the instrument; time points at which the instrument was used; primary/secondary outcomes; and cutoff values). One author reviewed and compiled all the data into a final standardized table. Disagreements were resolved through discussion or by a third author (E.B.C.). If not reported in the original studies, the outcome domains were defined via the original validation of the outcome measure extracted or by contacting the authors (by e-mail). Finally, the extracted domains were categorized according to the PROMIS framework.[20,21]

- Data Analysis

A descriptive analysis (frequencies and percentages) using the Statistical Package for the Social Sciences Version 22.0 (IBM , Chicago, IL, USA was performed.

- Role of the Funding Source

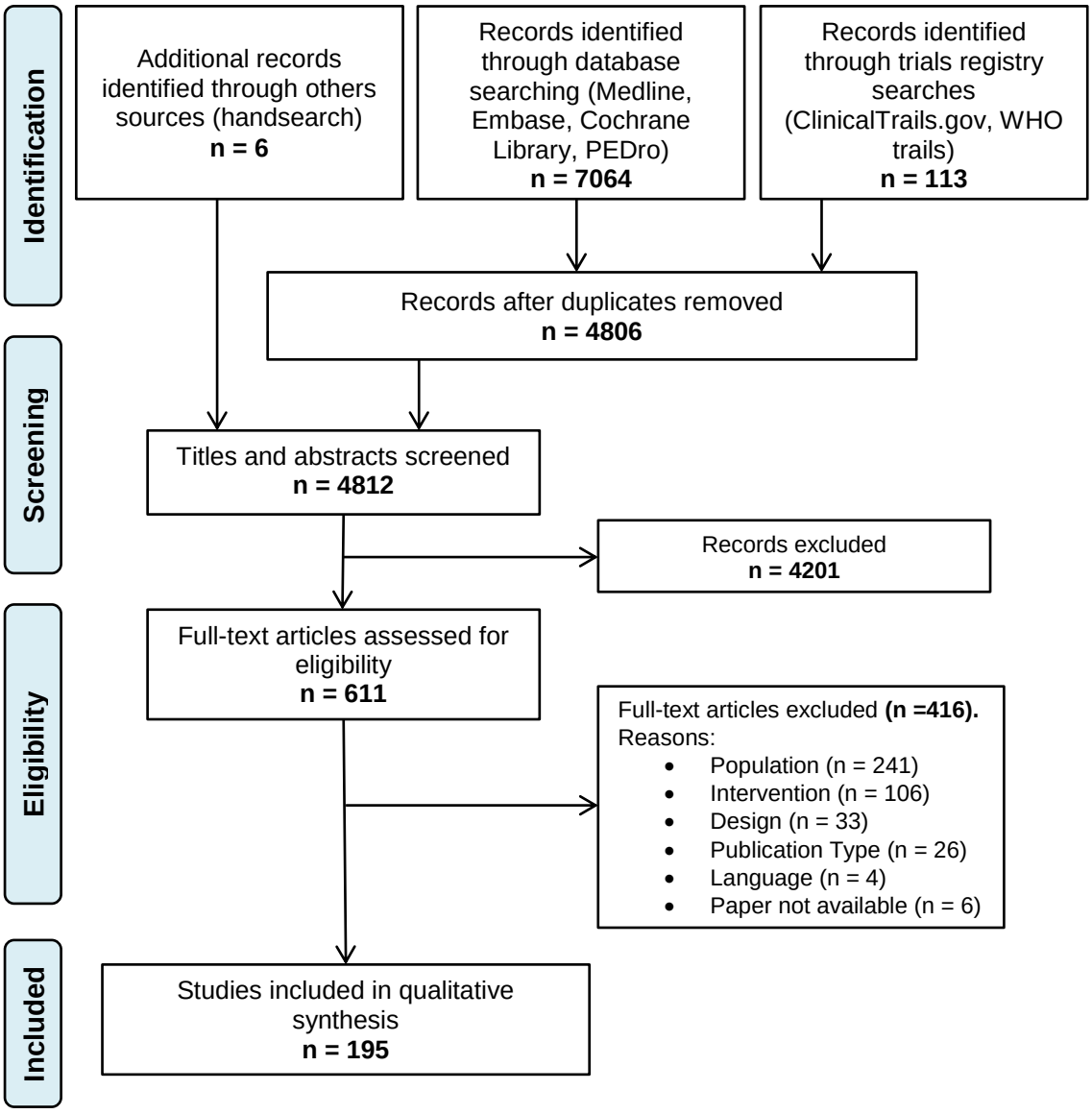
This study was funded by Fundação para a Ciência e Tecnologia, which played no role in the design, conduct, or reporting of this study.

Results

- Study Selection

From the 4812 articles identified in the initial searches, 611 were selected for a full-text assessment and 195 were deemed eligible for this review. A flowchart of the literature search and study selection is presented in Figure 1.

Figure 1: Flowchart of results of search strategy and selection of studies.



- Characteristics of Included Trials

Table 1 summarizes the characteristics of the 195 included studies. The majority of the trials were published between 2013 and 2017 and were conducted, most frequently, in Brazil (n = 30; 15.4%), Spain (n = 19; 9.7%), Iran (n = 16; 8.2%), and India (n = 15; 7.7%). The sample sizes ranged from 10 to 320 participants (mean = 67.0; SD = 53.3).

The reference list of all the included studies is presented in Supplementary 1 (available at https://academic.oup.com/ptj).

Table 1. Characteristics of included studies

Characteristics	Studies – N (%)
Year of Publication	
2008-2012	38 (19.5%)
2013-2017	72 (36.9%)
2018 – 2019 & Ongoing Studies	85 (43.6%)
Country	
Brazil	30 (15.4%)
Spain	19 (9.7%)
Iran	16 (8.2%)
India	15 (7.7%)
Nigeria	11 (5.6%)
Turkey	11 (5.6%)
USA	11 (5.6%)
Thailand	10 (5.1%)
Others (<10)	72 (36.9%)
Number of intervention arms	
Two	148 (75.9%)
Three	38 (19.5%)
Four	9 (4.6%)
Five	1 (0.5%)
Participants*	
Sample Size [Mean(SD); (Min-Max)]	67.0 (53.3); (10-320)
Mean Age [Mean(SD); (Min-Max)]	40.8 (7.7); (20.9-59.3)
Specification of primary outcome domain	
Yes	126 (64.6%)
No	69 (35.4%)
Number of Domains	
One - Two	34 (17.4%)
Three	48 (24.6%)
Four	40 (20.5%)
Five	31 (15.9%)
≥ Six	42 (21.5%)
Cutoff values utilization*	
No	92 (66.6%)
Yes	46 (33.3%)
Individual Analysis	16 (11.6%)
Mean Change Analysis	27 (19.6%)
Both	3 (2.2%)
Legend: * Based on 138 finished studies	

- Numbers of Domains and Instruments Used in CLBP Trials

Based on the outcome measures, 52 different domains were identified in the 195 included studies. However, only 21 domains were reported in >3% of trials. The number of domains per study ranged from 1 to 8, and the majority of authors used between 3 and 5 domains. To assess the 52 identified domains, 182 outcome measures were used (Tab. 2). Fifteen trials[24–38] did not describe the domains or

instruments used, and a total of 42 instruments were not identified. The domains and instruments/clinical measures used in at least 3% of included studies are summarized in Table 2. The total numbers of domains and instruments used in included studies are presented in detail in Supplementary 2 (available at https://academic.oup.com/ptj).

Table 2. Outcome domains and measurement instruments reported in included studies

		Domains	Studies N (%)	Instruments	Studies N (%)
Global Health		**Health-related Quality of Life**	45 (23.1%)	**Total number of measurement instruments**	7
		Primary Outcome	8	SF-36	20 (10.3%)
				EuroQol-5D	10 (5.1%)
				Other instrument (reported in ≤3% of trials)	10 (5.1%)
		Global Improvement	30 (15.4%)	**Total number of measurement instruments**	5
		Primary Outcome	1	Global Perceived Effects Scale	17 (8.7%)
				Other instrument (reported in ≤3% of trials)	14 (7.2%)
		Satisfaction with intervention	16 (8.2%)	**Total number of measurement instruments**	5
		Primary Outcome	0	Global/ Specific question	8 (4.1%)
				Other instrument (reported in ≤3% of trials)	8 (4.1%)
		General Health	13 (6.7%)	**Total number of measurement instruments**	4
		Primary Outcome	0	SF-36 General Health Subscale	10 (5.1%)
				Other instrument (reported in ≤3% of trials)	3 (1.5%)
Physical Health	Symptoms	**Pain Intensity**	171 (87.7%)	**Total number of measurement instruments**	6
		Primary Outcome	76	Visual Analogue Scale	91 (46.7%)
				Numerical Rating Scale (11-points)	54 (27.7%)
				Numeric Pain Scale (11-points)	10 (5.1%)
				Other instrument (reported in ≤3% of trials)	14 (7.2%)
		Pain (multidimensional evaluation)	11 (5.6%)	**Total number of measurement instruments**	4
		Primary Outcome	3	Short Form McGill Pain Questionnaire	12 (6.2%)
				SF-36 Pain Subscale	10 (5.1%)
				Other instrument (reported in ≤3% of trials)	2 (1.5%)
		Pain pressure threshold	11 (5.6%)	**Total number of measurement instruments**	1
		Primary Outcome	0	Algometer	11 (5.6%)
				Other instrument (reported in ≤3% of trials)	0
		Fatigue and Vitality	10 (5.1%)	**Total number of measurement instruments**	2
		Primary Outcome	0	SF-36 Vitality Subscale	9 (4.6%)
				Other instrument (reported in ≤3% of trials)	1 (0.5%)
	Function	**Disability**	165 (84.6%)	**Total number of measurement instruments**	14
		Primary Outcome	67	Oswestry LBP Disability Index	89 (45.6%)
				Roland-Morris Disability Questionnaire	73 (37.4%)
				SF-36 Physical functioning Subscale	17 (8.7%)
				Quebec Back Pain Disability Scale	12 (6.2%)
				Patient Specific Functional Scale	9 (4.6%)
				Other instrument (reported in ≤3% of trials)	17 (8.7%)
		Spine Mobility	62 (31.8%)	**Total number of measurement instruments**	14
		Primary Outcome	7	Inclinometer/ Goniometer	20 (10.3%)
				Fingertip-to-floor distance test	17 (8.7%)
				Schober test	16 (8.2%)
				Other instrument (reported in ≤3% of trials)	24 (12.3%)
		Muscle strength/ endurance	52 (26.3%)	**Total number of measurement instruments**	28
		Primary Outcome	3	Sorensen test	15 (7.7%)
				McQuade test	11 (5.6%)
				Dynamometer	10 (5.1%)
				Other instrument (reported in ≤3% of trials)	35 (18%)
		Neuromuscular parameters (Recruitment/ Thickness/ Fatigue)	35 (18%)	**Total number of measurement instruments**	3
				Surface electromyography	21 (10.8%)
				Ultrasound image	13 (6.7%)
		Primary Outcome	12	Other instrument (reported in ≤3% of trials)	8 (4.1%)

		Physical Activity Primary Outcome	8 (4.1%) 0	**Total number of measurement instruments** Baecke Questionnaire of Habitual Physical Activity International Physical Activity Questionnaire Other instrument (reported in ≤3% of trials)	3 4 (2.1%) 3 (1.5%) 1 (0.5%)
		Functional Capacity Primary Outcome	8 (4.1%) 0	**Total number of measurement instruments** Sit-to-stand test Other instrument (reported in ≤3% of trials)	7 4 (2.1%) 11 (5.6%)
		Balance Primary Outcome	8 (4.1%) 0	**Total number of measurement instruments** Single-Limb stance test Other instrument (reported in ≤3% of trials)	7 3 (1.5%) 8 (4.1%)
Mental Health	**Affect**	**Fear of Movement** Primary Outcome	52 (26.6%) 5	**Total number of measurement instruments** Tampa Scale of kinesiophobia Fear-Avoidance Beliefs Questionnaire Other instrument (reported in ≤3% of trials)	5 30 (15.4%) 20 (10.3%) 3 (1.5%)
		Psychological Functioning Primary Outcome	35 (17.9%) 0	**Total number of measurement instruments** SF-36 Emotional Subscale Hospital Anxiety and Depression Scale Other instrument (reported in ≤3% of trials)	9 16 (8.2%) 6 (3.1%) 13 (6.7%)
	Cognition	**Pain catastrophizing** Primary Outcome	9 (4.6%) 1	**Total number of measurement instruments** Pain Catastrophizing Scale Other instrument (reported in ≤3% of trials)	2 8 (4.1%) 1 (0.5%)
		Self-Efficacy Primary Outcome	8 (4.1%) 1	**Total number of measurement instruments** Pain Self-efficacy Questionnaire Other instrument (reported in ≤3% of trials)	3 7 (3.6%) 2 (1.5%)
Social Health	**Function**	**Work Ability/ Status** Primary Outcome	12 (6.2%) 0	**Total number of measurement instruments** Specific question (return to work: yes or not) Other instrument (reported in ≤3% of trials)	6 5 (2.6%) 7 (3.6%)
		Social Functioning Primary Outcome	9 (4.6%) 0	**Total number of measurement instruments** SF-36 Social Subscale Other instrument (reported in ≤3% of trials)	1 9 (4.6%) 0

Legend: SF-36- Outcome 36-item Short Form Health Survey

- Outcome Domains According to the PROMIS Framework

Considering the PROMIS framework, only 14 studies (7.2%) assessed all 4 health core areas (global, physical, mental, and social health), while 6 studies (3.1%) assessed the physical, mental, and social health areas. The PROMIS physical and mental health core areas were assessed together in 59 studies (30.3%). The detailed analysis according to the PROMIS health core areas is presented in Tables 2 and 3. A summary analysis is presented below.

Global health

Some measurement instruments identified spanned several PROMIS health core areas (for instance, when the total score of the Medical Outcomes Study 36-Item Health Survey Questionnaire is used) or represented general evaluations of health. For this review, outcome domains such as quality of life (when only 1 global score was used) or

satisfaction were considered to be global health domains (health core area) within the PROMIS framework.[20] Four domains were identified from 23 different instruments and were used in 68 (34.9%) of the 195 studies. The most reported domains in this health core area were health-related quality of life and global improvement, which were used in 45 (23.1%) and 30 (15.4%) trials, respectively. The 36-item Short Form Health Survey (SF-36) was the instrument most frequently used.

Physical health core area

The physical health core area is composed of the symptoms and functions domains and was assessed in all the included studies. The pain intensity (symptoms) and disability (function) domains were widely used to measure the outcomes of physical therapist interventions (87.7% and 84.6% of trials, respectively). Disability was assessed using a wide range of instruments (14 different instruments), with the Oswestry Disability Index and Roland-Morris Disability Questionnaire being the most commonly used. To assess pain intensity, the visual analog scale (91/195 studies; 46.7%) was the most frequently implemented instrument. Other domains, such as spine mobility (62/195 studies; 31.8%) and muscle strength/endurance (52/195 studies; 26.7%), were also identified. Objective instruments and clinical assessments were frequently used to assess these domains instead of patient-reported outcome measures.

Mental health core area

The mental health core area was assessed in 75 of the 195 studies (38.5%). Fear of movement (PROMIS affect domain) was the most assessed domain and was measured by the Tampa Scale of Kinesiophobia or the Fear-Avoidance Beliefs Questionnaire in the majority of these studies. Psychological functioning (PROMIS affect domain), as well as pain catastrophizing and self-efficacy (PROMIS cognition domain), were uncommon domains and used in <20% of the studies. No domain was identified within the PROMIS behavior domain.

Social health core area

The social health core area was rarely assessed (19/195 studies; 9.7%) and only 2 domains (work ability and social functioning) were identified. Thus, no domain was

assigned to relationships (the second domain of the social health core area of the PROMIS framework).

- Frequency of PROMIS Health Core Areas Over Time

The frequency and proportion of studies that assessed the PROMIS domains individually or in combination over time is shown in Table 3. This analysis showed a reduction in the use of PROMIS mental and social domains over time. In contrast, the use of physical and global health domains was similar during the periods analyzed. The proportion of studies that used a combination of multiple domains was small at all time points analyzed.

Table 3: Utilization of PROMIS health areas over time

	Total	Year of publication		
		2008-2012	2013-2018	2018-2019 & Ongoing
	N=195	N= 38	N= 72	N= 85
PROMIS core health areas used				
Physical Health	185 (100%)	38 (100%)	72 (100%)	85 (100%)
Mental Health	75 (38.5%)	19 (50%)	29 (40.3%)	27 (31.8%)
Social Health	19 (9.7%)	6 (15.8%)	10 (13.9%)	3 (3.5%)
Global Health	68 (34.9%)	14 (36.8%)	26 (36.1%)	28 (33%)
PROMIS core health areas combinations				
Physical, Mental, Social and Global Health	14 (7.2%)	4 (10.5%)	9 (12.5%)	1 (1.2%)
Physical, Mental and Social Health	6 (3.1%)	2 (5.3%)	4 (5.6%)	0
Physical and Mental Health	59 (30.3%)	14 (36.8%)	18 (25%)	27 (31.7%)
Physical and Social Health	2 (1%)	2 (5.3%)	0	0

- Primary and Secondary Outcome Specification

Of the 195 trials, 126 (64.6%) adequately specified primary and secondary outcome domains. Of these 126 trials, 76 trials (39.0% of the 195 trials) and 67 trials (34.4% of the 195 trials) defined pain intensity and/or disability as primary outcome domains, respectively. Other primary outcome domains were residual (neuromuscular parameters = 12; health-related quality of life = 8; spine mobility = 7).

- Application of Cutoff Values

Of the 138 finished studies, forty-six trials (33.3%) used at least 1 cutoff in the result analysis. These cutoff values were applied using individual analysis (16 trials; 11.6%), mean change analysis (27 trials; 19.6%), or both (3 trials; 2.2%) (Table 1). Forty-five different cutoff values corresponding to 10 outcome domains and 16 instruments were identified. Cutoff values for the pain intensity and disability domains were the most

frequently reported (44 and 40, respectively). A reduction of 2 points in the numeric rating scale (Fig. 2) and 10 points in the Oswestry Disability Index (Fig. 3) were the most common cutoff values reported (12 and 9 trials each, respectively).

Figure 2: Cut-off values for pain intensity (VAS = Visual Analog Scale; NRS = Numeric Rating Scale)

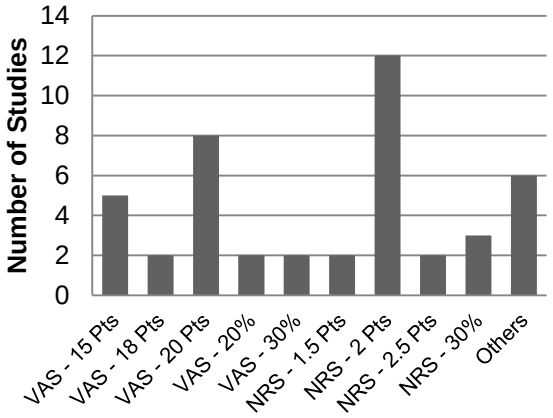
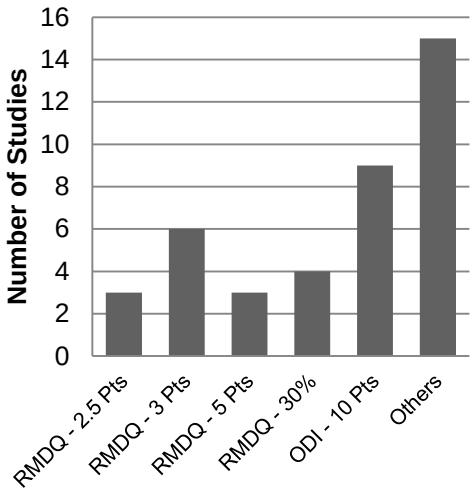


Figure 3: Cut-off values for disability (RMDQ = Roland-Morris Disability Questionnaire; ODI = Oswestry Disability Index)



Discussion

In this systematic review, an overview of the outcome domains, outcome measures and cutoff values used in recent randomized control trials including adults with CLBP undergoing physical therapist interventions was obtained. The main findings are the poor accordance of the outcome domains identified with the PROMIS framework and the diversity in how physical therapy outcomes are measured. First, only 14 studies assessed the health core areas of the PROMIS framework. Second, a large number of

outcome domains and instruments were identified. Overall, 52 different domains were reported, but only 21 were used in >3% of the 195 included studies. Finally, only one-third of the trials used cutoff values in their interpretation of results and the cutoff values reported varied widely across trials.

The importance of health outcome assessment considering a conceptual framework integrating a comprehensive number of health-related domains is widely recognized.[18,19] However, few studies included in this review covered all health core areas of the PROMIS framework. Furthermore, the PROMIS social and mental health core areas were rarely assessed despite robust evidence suggesting interactions between social, physical, psychological and functional issues in people with low back pain.[39–41] In contrast, physical health domains were used in all included studies. An important implication may be the under representation of the relevant health-related aspects in the measurement of the physical therapy outcomes. While physical domains appear to be overvalued, others are systematically not considered. This problem can be a serious threat to the validity of outcome measurement, which in turn can affect care delivery through the outcomes that are valued and funded.[16]

In the last decade, rising evidence has reinforced the impact of chronic pain on multiple health-related aspects while several initiatives (eg, OMERACT, IMMPACT, and PROMIS) have suggested the assessment of other dimensions of health beyond physical health.[20,42,43] Therefore, an increasing use over time of social and mental outcome domains was expected. Controversially, the findings of this review show a decreasing use of these domains. In the case of published studies, the selective reporting of outcomes (outcome reporting bias)[44] may help to explain these findings. However, the same trend has been observed for ongoing studies. In general, these results suggest that there has been no relevant impact of recent recommendations and frameworks on how physical therapy outcomes are measured over time and that it is a current problem.

Several reasons may have influenced physical therapists' choice of outcome domains as well as their poor overlap with the PROMIS framework. First, the biomedical perspective of physical therapists persists and is well reported in the literature.[45,46] This could help to explain the great use of the domains categorized in the physical dimension of the PROMIS framework. The relationship between biomedical beliefs and the interventions provided is well established,[46,47] consequently, it seems plausible that the biomedical profile also influences the choice of outcome domains and instruments. For example, physical therapists delivering strength exercise are more likely to measure the impact of intervention on strength or function than on psychological and

behavioral domains. Second, current frameworks such as the PROMIS initiative may be too broad and their domains might not be specific enough to the expected outcomes of physical therapist intervention in patients with CLBP. Therefore, the development of a conceptual framework or a set of domains specifically for physical therapist intervention may improve this lack of compliance. Finally, the validity of the mental and social instruments tends to be influenced by patient acceptance as well as social aspects.[48] For example, patients tend to underestimate health problems less socially understood (eg, depression) while they can overestimate other socially desirable aspects (eg, social relationships). For these reasons, the lower utilization of these domains by physical therapists and researchers can be an expected consequence.

Another finding of this review was the variability of the domains and instruments used for each PROMIS domain. This diversity in the low back pain trials is not new,[49,50] but data within the physical therapy context were not known. For example, 7 different domains were identified regarding the PROMIS function domain and 77 different instruments were used. Based on this example, it is easy to anticipate that a comparison between trials would be complex. Similarly, the significant utilization of objective instruments and clinical assessment in the included studies may be an element for discussion. While patient-reported outcomes gain increasing prominence in physical therapy research,[51] a relevant number of clinician-derived measures such as goniometer and surface electromyography were found in this review. The biomedical profile already mentioned above may also explain these findings. Therefore, after clarifying the question of “what to measure”, the question of precisely “how to measure” must be the next step in this research area.

In this review, pain intensity and disability were identified as the most commonly used domains, as well as the ones most frequently used as primary outcomes. These domains seem to be the most important for physical therapists and researchers, and their dominance has also been reported in previous studies.[15,52,53] However, there is a growing recognition of the discrepancy between these researcher domains and the chronic pain patients’ evaluation of the benefits of each intervention.[17,54,55] Previous qualitative studies have reported that changes in pain and disability are not a reliable indicator of improvement from the patients’ perspective.55,56 Others domains such as coping, sleep disturbance, psychological status or work ability also seem to be relevant,[13,17,55,56] but have rarely been identified in physical therapy studies. The fact that patients with chronic pain do not believe in the complete resolution of their pain is a possible reason for valuing other health domains.[54] This potential discrepancy

reinforces the need to follow a conceptual framework that integrates the perspectives of different stakeholders and should be the subject of analysis in future studies.

Finally, a large number of cutoff values were identified from the included studies. However, only 46 used this strategy to facilitate the clinical interpretation of the results. Usually, these cutoffs are derived from studies with specific methodologies that seek to identify changes in the different domains or instruments that may be considered clinically important.[57,58] Their use in effectiveness studies to interpret whether the magnitude of the effect is clinically relevant has been consistently recommended in the last decade.[57,59] The results of this review showed a poor use of this method as well as a high variability in the cutoff values used. Differences ≥ 2 points in the NRS and ≥ 10 points in the ODI were the most commonly used and are in line with current recommendations for patients with low back pain.[60] Previously, Henschke et al (2014) performed a review to identify the use of cutoff values in randomized control trials published up to December 2008, which integrate patients with CLBP.[61] Their results were similar to those of this review, which seems to mean that, in more recent trials, there has been no greater use of this method as well as a more uniform choice of cutoff values used.

The main strength of this review is the comprehensive literature search, which yielded a wide range of relevant studies and a higher range of data of interest about how physical therapy outcomes are being measured. This review appears to be the first in the physical therapy and CLBP context and may offer an important starting point for future research.

Some potential limitations of this review need to be considered. Previous studies have reported a discrepancy between instruments described in study protocols and those reported in published studies.[44] Therefore, the domains and instruments found may not accurately reflect current research practices. In addition, a relevant proportion of included studies did not describe the instruments used. Despite several attempts to contact the authors, only a few were successful and a large number of instruments were classified as “not defined”. Only studies fully published in English and after 2008 were included. Thus, an unknown number of studies have not been identified due to the first restriction (language bias), while this study’s findings are only representative of the literature published in the last decade. Finally, studies including young and elderly were not considered in this review. Because CLBP has a high prevalence in these populations,[4] this limitation should be addressed in future studies.

Conclusions

In conclusion, there is a poor overlap between the PROMIS framework domains and the outcome domains used to define the effectiveness of physical therapy in adults with CLBP. This problem has not improved over time and has been identified in the most recent and ongoing studies. In addition, a wide diversity of outcome domains and instruments for each PROMIS domain was found. This suggests that there may be other potential benefits resulting from physical therapist interventions that are not being measured. Further research is required to clarify which domains and instruments are most suitable to assess the effectiveness of physical therapy in adults with CLBP, considering the perspective of the main stakeholders and the potential benefits of physical therapy.

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Systematic Review Registration

This systematic review was registered in PROSPERO, the International Prospective Register of Systematic Reviews (ref. no. CRD42018093985).

Disclosures

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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Appendix 1.

Search Strategy

Medline via PubMed

1. randomized controlled trial [pt]
2. controlled clinical trial [pt]
3. comparative study [pt]
4. evaluation studies [pt]
5. clinical trial [pt]
6. randomi$ed [tiab]
7. placebo [tiab]
8. drug therapy [sh]
9. randomly [tiab]
10. trial [tiab]
11. groups [tiab]
12. double-blind method [mh]
13. single-blind method [mh]
14. random allocation [mh]
15. or #1–#14

16. animals [mh] not (humans [mh] and animals [mh])
17. #15 not #16

18. back pain[mh]
19. back pain [tiab]
20. low-back pain[mh]
21. low back pain [tiab]
22. sciatica[mh]
23. sciatic neuropathy [mh]
24. sciatica[tiab]
25. backache[tiab]
26. coccyx[tiab]
27. coccydynia[tiab]
28. dorsalgia[tiab]
29. lumbar pain[tiab]

30. spondylosis[tiab]

31. lumbago[tiab]

32. back disorder$ [tiab]

33. or #18–#32

34. physical therapy modalities [mh]

35. electric stimulation therapy [mh]

36. musculoskeletal manipulations [mh]

37. exercise movement techniques [mh]

38. exercise therapy [mh]

39. patient education as topic [mh]

40. (physiotherapy or “physical therapy”) [tiab]

41. (“manual therapy” or “manipulative therapy”) [tiab]

42. (manipulation or massage or mobilization) [tiab]

43. (“exercise therapy” or “therapeutic exercise”) [tiab]

44. (“aquatic exercise” or “water therapy” or hydrotherapy) [tiab]

45. (electrotherapy or tens or “transcutaneous electrical nerve stimulation” or “therapeutic ultrasound” or interferential or “shortwave diathermy” or “laser therapy ” or “heat therapy” or cryotherapy or shockwaves) [tiab]

46. education [tiab]

47. advice [tiab]

48. or #34–#47

49. “last 10 year” [dp]

50. #17 and #33 and #48 and #49

CENTRAL (Cochrane Library)

1. MeSH descriptor: [Back Pain] explode all trees

2. MeSH descriptor: [Low Back Pain] explode all trees

3. MeSH descriptor: [Sciatica] explode all trees

4. MeSH descriptor: [Spinal Diseases] explode all trees

5. back pain: ti,ab,kw

6. dorsalgia: ti,ab,kw

7. backache: ti,ab,kw

8. coccydynia: ti,ab,kw

9. sciatica: ti,ab,kw

10. spondylosis: ti,ab,kw

11. lumbago: ti,ab,kw

12. #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11

13. MeSH descriptor: [Physical Therapy Modalities] explode all trees

14. MeSH descriptor: [Exercise Movement Techniques] explode all trees

15. MeSH descriptor: [Exercise Therapy] explode all trees

16. MeSH descriptor: [Musculoskeletal Manipulations] explode all trees

17. MeSH descriptor: [Electric Stimulation Therapy] explode all trees

18. MeSH descriptor: [Patient Education as Topic] explode all trees

19. (physiotherap* or “physical therap*” or “manual therap*” or exercis* “manipulative therap*”): ti,ab,kw

20. (electrotherapy or TENS or “transcutaneous electrical nerve stimulation” or “therapeutic ultrasound” or interferential or shockwave or “shortwave diathermy” or “laser therapy ” or “heat therapy” or cryotherapy): ti,ab,kw

21. (manipulation or massage or mobili?ation): ti,ab,kw

22. (“aquatic exercise” or “water therapy”or hydrotherapy): ti,ab,kw

23. education: ti,ab,kw

24. advice: ti,ab,kw

25. “back schools”: ti,ab,kw

26. #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25

27. #12 and #26 Publication Year from 2008 to 2018, in Trials

Appendix 2

Definitions of Interventions

Definition of interventions	
Manual Therapy	Manual therapy includes any physiotherapist-applied movement of the joints and other structures, for example mobilisation (of which several types exist), manipulation or massage[62]. Manipulation is a localised force of high velocity and low amplitude directed at specific spinal segments or regions. Mobilisations use low-velocity, small- or large-amplitude passive movement techniques or neuromuscular techniques within the patient's physiological range of motion[63]. Therapeutic massage is defined as the manipulation of the soft tissue of whole body areas to bring about generalised improvements in health, such as relaxation or improved sleep, or specific physical benefits, such as relief of muscular aches and pains[64].
Therapeutic Exercise	Exercise includes any purposeful movement of a joint, muscle contraction or prescribed activity, which may be performed under the supervision of a physiotherapist or unsupervised at home [62]. May include modalities such as muscle strengthening, flexibility, stretching, aerobic exercises, general mobility exercises, and aquatic exercises.
Electrotherapy	Electrotherapy modalities (also known as electrophysical agents) are types of physical therapy that aim to reduce pain and improve function via an increase in energy (electrical, sound, light, or thermal) into the body. Electrotherapy modalities included therapeutic ultrasound, laser therapy, transcutaneous electrical nerve stimulation, pulsed electromagnetic, bipolar interferential current, electromyographic biofeedback, phonophoresis, iontophoresis, shock waves and short wave diathermy [65].
Education	Patient education was defined as a systematic experience that consists of one or more methods, such as the provision of information and advice and behaviour modification techniques, which influence the way the patient experiences his illness and/or his knowledge and health behaviour, aimed at improving or maintaining or learning to cope with a condition. Patient education for patients with chronic low-back pain was operationalised as any advise or information (verbal, written or audiovisual) given by a physiotherapist in order to improve patients' understanding of their back problems and what they should do about them [66].

Appendix 3

Full list of outcome domains and instruments

PROMIS Framework	Domains	Studies N (%)	Instruments	Studies N (%)
Global Health	**Health-related Quality of Life** Primary Outcome	45 (23.1%) 8	**Total number of measurement instruments**	7
			SF-36	20 (10.3%)
			EuroQol-5D	10 (5.1%)
			SF-12	4 (2.1%)
			WHOQOL-BREF questionnaire	1 (0.5%)
			Dallas pain questionnaire	1 (0.5%)
			PROMIS measures – low back pain	1 (0.5%)
			Nottingham Health Profile	1 (0.5%)
			Not Defined	2 (1%)
	Global Improvement Primary Outcome	30 (15.4%) 1	**Total number of measurement instruments**	5
			Global Perceived Effects Scale	17 (8.7%)
			Global/ Specific question	4 (2.1%)
			Likert self-rating scale	4 (2.1%)
			Global rating of change scale	4 (2.1%)
			Patient global rating of improvement	2 (1%)
	Satisfaction with intervention Primary Outcome	16 (8.2%) 0	**Total number of measurement instruments**	5
			Global/ Specific question	8 (4.1%)
			Patient satisfaction questionnaire	2 (1%)
			MedRisk Instrument for Measuring Patient Satisfaction With Physical Therapy Care	2 (1%)
			VAS	2 (1%)
			Not Defined	2 (1%)
			Other instrument (reported in ≤3% of trials)	8 (4.1%)
	General Health Primary Outcome	13 (6.7%) 0	**Total number of measurement instruments**	4
			SF-36 General Health Subscale	10 (5.1%)
			General Health Questionnaire	1 (0.5%)
			Self-rated health question	1 (0.5%)
			EQ-VAS	1 (0.5%)
Physical Health Symptoms	**Pain Intensity** Primary Outcome	171 (87.7%) 76	**Total number of measurement instruments**	6
			VAS	91 (46.7%)
			Numerical Rating Scale (11-points)	54 (27.7%)
			Numeric Pain Scale (11-points)	10 (5.1%)
			Verbal Rating Scale	5 (2.6%)
			101-points Numerical rating scale	1 (0.5%)
			Pain Perception Scale	1 (0.5%)
			Not Defined	7 (3.6)
	Pain (multidimensional evaluation) Primary Outcome	11 (5.6%) 3	**Total number of measurement instruments**	4
			Short Form McGill Pain Questionnaire	12 (6.2%)
			SF-36 Pain Subscale	10 (5.1%)
			Chronic Pain Questionnaire	1 (0.5%)
			Brief Pain Inventory	1 (0.5%)
	Pain pressure threshold Primary Outcome	11 (5.6%) 0	**Total number of measurement instruments**	1
			Algometer	11 (5.6%)
	Fatigue and Vitality Primary Outcome	10 (5.1%) 0	**Total number of measurement instruments**	2
			SF-36 Vitality Subscale	9 (4.6%)
			Fatigue Impact Scale	1 (0.5%)

Function	**Disability** Primary Outcome	165 (84.6%) 67	**Total number of measurement instruments**	14
			Oswestry LBP Disability Index	89 (45.6%)
			Roland-Morris Disability Questionnaire	73 (37.4%)
			SF-36 Physical functioning Subscale	17 (8.7%)
			Quebec Back Pain Disability Scale	12 (6.2%)
			Patient Specific Functional Scale	9 (4.6%)
			Not defined	5 (2.6%)
			Aberdeen Low Back Disability Scale	2 (1%)
			Functional Rating Index	2 (1%)
			Hannover Functional Ability Questionnaire	2 (1%)
			Back Pain Functional Scale	1 (0.5%)
			VAS handicap	1 (0.5%)
			Waddel Disability Index	1 (0.5%)
			World Health Organization Disabilty Assessment Schedule (WHODAS 2.0)	1 (0.5%)
			Pain disability index	1 (0.5%)
			Orebro Msk Pain Questionnaire	1 (0.5%)
	Spine Mobility Primary Outcome	62 (31.8%) 7	**Total number of measurement instruments**	14
			Inclinometer/ Goniometer	20 (10.3%)
			Fingertip-to-floor distance test	17 (8.7%)
			Schober test	16 (8.2%)
			Not Defined	9 (4.6%)
			Sit-and-reach test	3 (1.5%
			Zebris motion analysis	2 (1%)
			Measuring Tape	2 (1%)
			Fleximeter	2 (1%)
			Thigh-leg-angle	1 (0.5%)
			Back range of motion device	1 (0.5%)
			Valedo Shape	1 (0.5%)
			Flexicurve Device	1 (0.5%)
			SpinalMouse Device	1 (0.5%)
			Ihandy level	1 (0.5%)
	Muscle strength/ endurance Primary Outcome	52 (26.3%) 3	**Total number of measurement instruments**	28
			Sorensen test	15 (7.7%)
			McQuade test	11 (5.6%)
			Dynamometer	10 (5.1%)
			Not Defined	8 (4.1%)
			Unsupported trunk holding tests	2 (1%)
			Prone/Side Bridge Test	2 (1%)
			Krause-Weber test	2 (1%)
			Stabilizer pressure biofeedback	1 (0.5%)
			Modified lower back machine	1 (0.5%)
			Trunk-curling test	1 (0.5%)
			Leg-lowering test	1 (0.5%)
			Six movement control tests	1 (0.5%)
			Abdominal endurance test	1 (0.5%)
			Extensor endurance test	1 (0.5%)
			Side support endurance test	1 (0.5%)
			Shirado test	1 (0.5%)
			Maximum Isometric Strength of the Lumbar and hip extensors (MISL test)	1 (0.5%)
			Sharmann Abdominal test	1 (0.5%)
			Movement control test battery	1 (0.5%)
			Lifting capacity test	1 (0.5%)
			Isometric lumbar extension test	1 (0.5%)
			Load cell fixed in the wall	1 (0.5%)
			Ito Test	1 (0.5%)
			SICR Test	1 (0.5%)
			SDSLT Test	1 (0.5%)
			Lateral plank test	1 (0.5%)
			Stress test	1 (0.5%)
			Fatigue Test	1 (0.5%)

		Neuromuscular parameters (Recruitment/ Thickness/ Fatigue) Primary Outcome	35 (18%) 12	**Total number of measurement instruments**	3
				Surface electromyography	21 (10.8%)
				Ultrasound image	13 (6.7%)
				Stabilizer pressure biofeedback	4 (2.1)
				Not Defined	4 (2.1)
		Physical Activity Primary Outcome	8 (4.1%) 0	**Total number of measurement instruments**	3
				Baecke Questionnaire of Habitual Physical Activity	4 (2.1%)
				International Physical Activity Questionnaire	3 (1.5%)
				ActivPAL – activity monitor	1 (0.5%)
		Functional Capacity Primary Outcome	8 (4.1%) 0	**Total number of measurement instruments**	7
				Sit-to-stand test	4 (2.1%)
				6-min walk test	3 (1.5%)
				15,2m walking test	3 (1.5%)
				Shuttle walking test	1 (0.5%)
				Get-up-and-go test	1 (0.5%)
				Fifty-foot walk test	1 (0.5%)
				1 minute stair climbing test	1 (0.5%)
				Not defined	1 (0.5%)
		Balance Primary Outcome	8 (4.1%) 0	**Total number of measurement instruments**	7
				Single-Limb stance test	3 (1.5%)
				Overall stability index	2 (1.5%)
				Biodex Balance System	1 (0.5%)
				Modified clinical test of sensory interaction and balance	1 (0.5%)
				Variation on the platform displacement	1 (0.5%)
				Stork Balance Stand test	1 (0.5%)
				Y-Balance test	1 (0.5%)
				Not Defined	1 (0.5%)
Mental Health	**Affect**	**Fear of Movement** Primary Outcome	52 (26.6%) 5	**Total number of measurement instruments**	5
				Tampa Scale of kinesiophobia	30 (15.4%)
				Fear-Avoidance Beliefs Questionnaire	20 (10.3%)
				Harmfulness of the exercises using a numeric rating scale	1 (0.5%)
				Waddel questionnaire related to work and physical activity	1 (0.5%)
				Specific question	1 (0.5%)
		Psychological Functioning Primary Outcome	35 (17.9%) 0	**Total number of measurement instruments**	9
				SF-36 Emotional Subscale	16 (8.2%)
				Hospital Anxiety and Depression Scale	6 (3.1%)
				Beck Depression Inventory	5 (2.6%)
				VAS Anxiety	2 (1%)
				Specific question (depression/stress)	2 (1%)
				Modified Zung Depression Index	1 (0.5%)
				Hopkins Symptoms Checklist	1 (0.5%)1
				Anxiety Inventory	(0.5%)
				Somatic Perception Questionnaire	1 (0.5%)
	Cognition	**Pain catastrophizing** Primary Outcome	9 (4.6%) 1	**Total number of measurement instruments**	2
				Pain Catastrophizing Scale	8 (4.1%)
				Specific question	1 (0.5%)
		Self-Efficacy Primary Outcome	8 (4.1%) 1	**Total number of measurement instruments**	3
				Pain Self-efficacy Questionnaire	7 (3.6%)
				General Self-efficacy scale	1 (0.5%)
				Exercise Self-efficacy questionnaire	1 (0.5 %)
Social Health	**Function**	**Work Ability/ Status** Primary Outcome	12 (6.2%) 0	**Total number of measurement instruments**	6
				Specific question (return to work: yes or not)	5 (2.6%)
				Days of LBP-related time off/ Sick-leave days	3 (1.5%)
				Percentage of full time work	1 (0.5 %)
				Days of Work	1 (0.5 %)
				Work productivity and activity impairment questionnaire	1 (0.5 %)
				Functional capacity evaluation - Work-related physical abilities	1 (0.5 %)
		Social Functioning Primary Outcome	9 (4.6%) 0	**Total number of measurement instruments**	1
				SF-36 Social Subscale	9 (4.6%)

Other domains and instruments identified			
Adherence	5 (2.6%)	**Total number of measurement instruments**	8
		Adherence to exercise - Specific question	2 (1%)
		Number of exercise class sessions attended	1 (0.5%)
		Completion of daily logbook	1 (0.5%)
		Self-rate home exercise adherence	1 (0.5%)
		Rates of compliance	1 (0.5%)
		Exercise log book – Exercise compliance	1 (0.5%)
		Sessions attendance	1 (0.5%)
		Exercise Adherence Rating Scale	1 (0.5%)
Medication use	5 (2.6%)	**Total number of measurement instruments**	1
		Specific Question	5 (2.6%)
Expectations	5 (2.6%)	**Total number of measurement instruments**	3
		Credibility and Expectancy Questionnaire	3 (1.5%)
		Baseline and exit Questionnaire	1 (0.5%)
		Pain Rehabilitation Expectations Scale	1 (0.5%)
Beliefs	4 (2.1%)	**Total number of measurement instruments**	3
		Back Beliefs Questionnaire	3 (1.5%)
		Holistic Complementary and Alternative Health questionnaire	1 (0.5%)
		Pain Beliefs Questionnaire	1 (0.5%)
Sleep	3 (1.5%)	**Total number of measurement instruments**	5
		Pittsburgh Sleep Quality Index	2 (1%)
		Insomnia Severity Index	1 (0.5%)
		Accelerometry	1 (0.5%)
		Pittsburgh Sleep diary	1 (0.5%)
		Specific question	1 (0.5%)
Proprioception	3 (1.5%)	**Total number of measurement instruments**	0
		Not Defined	3 (1.5%)
Heart Rate Variability	3 (1.5%)	**Total number of measurement instruments**	1
		Photoplethysmography	1 (0.5%)
		Not Defined	2 (1%)
Postural Changes	3 (1.5%)	**Total number of measurement instruments**	2
		Digital Camera	2 (1%)
		Zebris threedimensional ultrasonic movement analysis system	1 (0.5%
Kinematic data	3 (1.5%)	**Total number of measurement instruments**	3
		OptoGait System	1 (0.5%)
		Six-camera optoelectronic motion analysis system	1 (0.5%)
		SIMI Reality Motion Systems	1 (0.5%)
Sensory acuity	2 (1%)	**Total number of measurement instruments**	0
		Not Defined	2 (1%)
Lung Function	2 (1%)	**Total number of measurement instruments**	3
		Bourdon type pressure manometer	1 (0.5%)
		Measurement tape calibrated	1 (0.5%)
		Piko-6	1 (0.5%)
Blood parameters	2 (1%)	**Total number of measurement instruments**	0
		Not Defined	4 (2.1%)
Aerobic Capacity	2 (1%)	**Total number of measurement instruments**	2
		Six-minute walk test	2 (1%)
		Bruce protocol	2 (1%)
Illness Perception	2 (1%)	**Total number of measurement instruments**	1
		Illness Perception Questionnaire	1 (0.5%)
Bothersomeness	2 (1%)	**Total number of measurement instruments**	1
		11-point Numerical scale	2 (1%)
Readiness to change	1 (0.5%)	**Total number of measurement instruments**	1
		Readiness to change questionnaire	1 (0.5%)
Life Satisfaction	1 (0.5%)	**Total number of measurement instruments**	1
		Global/ Specific question	1 (0.5%)
Adverse Events	1 (0.5%)	**Total number of measurement instruments**	1
		Number of Participants with Adverse Events	1 (0.5%)
Central sensitization symptoms	1 (0.5%)	**Total number of measurement instruments**	1
		Central Sensitization Inventory	1 (0.5%)

Therapeutic Alliance	1 (0.5%)	**Total number of measurement instruments** The working aliance subscale of the Pain Rehabilitation Expectations Scale	1 1 (0.5%)
Self-Esteem	1 (0.5%)	**Total number of measurement instruments** Self-Esteem Questionnaire	1 1 (0.5%)
Baroreceptor sensitivity	1 (0.5%)	**Total number of measurement instruments** Finometer	1 1 (0.5%)
Care-Seeking	1 (0.5%)	**Total number of measurement instruments** Specific Question	1 1 (0.5%)
Time spend thinking of the pain	1 (0.5%)	**Total number of measurement instruments** Specific Question	1 1 (0.5%)
Interoceptive awareness	1 (0.5%)	**Total number of measurement instruments** Multidimensional Assessment of Interoceptive Awareness Questionnaire	1 1 (0.5%)
Number of low back pain relapses	1 (0.5%)	**Total number of measurement instruments** Specific Question	1 1 (0.5%)
Ground rotation force	1 (0.5%)	**Total number of measurement instruments** Not defined	1 1 (0.5%)
Baropodometric data	1 (0.5%)	**Total number of measurement instruments** Not defined	1 1 (0.5%)
Neuromuscular electrical tolerability	1 (0.5%)	**Total number of measurement instruments** Not defined	1 1 (0.5%)
Knowledge of pain	1 (0.5%)	**Total number of measurement instruments** Neurophysiology of pain questionnaire	1 1 (0.5%)
Skin thickness	1 (0.5%)	**Total number of measurement instruments** Skin fold calliper	1 1 (0.5%)

Legend: SF-36- 36-item Short Form Health Survey; VAS - Visual Analogue Scale

5.2. Study 2 - Cross-cultural adaptation and psychometric properties of the European Portuguese version of the Global Perceived Effect Scale in patients with chronic low back pain

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Disability and Rehabilitation, https://doi.org/10.1080/09638288.2019.1648568

DISABILITY AND REHABILITATION
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ORIGINAL ARTICLE

Cross-cultural adaptation and psychometric properties of the European Portuguese version of the Global Perceived Effect Scale in patients with chronic low back pain

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ABSTRACT

Purpose: To cross-culturally adapt the Global Perceived Effect Scale (GPES) into Portuguese and investigate its psychometric properties in patients with chronic low back pain.

Methods: Cross-cultural adaptation was carried out according to published guidelines. Along with measures for pain and disability, GPES was administered at baseline, 48-h later and post-intervention. To estimate test-retest reliability, the intraclass correlation coefficient was used. The validity was examined through the correlation between the GPES and the Patient Global Improvement Change Scale and the contribution of baseline status to GPES scores. Responsiveness was assessed by analyzing hypotheses regarding areas under the curve and correlations with changes in other measures.

Results: The test-retest reliability, the convergent validity and the contribution of the baseline status to GPES scores were demonstrated. The EPES correlated strongly with global perception of change ($r = 0.677$), and moderately with pain and disability changes ($r = 0.457$ and $r = 0.452$, respectively). Areas under the curve values of 0.71(95% CI = 0.607–0.825) and 0.83 (95% CI = 0.749–922) were found.

Conclusion: The GPES demonstrated adequate psychometric properties. This study's findings supported its use in clinical and research studies with patients with chronic low back pain.

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KEYWORDS
Global Perceived Effect Scale; cross-cultural adaptation; reliability; validity; responsiveness; interpretability; chronic low back pain

➤ IMPLICATIONS FOR REHABILITATION

- The European Portuguese version of the Global Perceived Effect Scale demonstrated adequate reliability, validity and responsiveness. This instrument is suitable to evaluate meaningful changes in patients with chronic low back pain.
- The contribution of baseline status to GPES scores was confirmed by specific and recommended methods. The use of the GPES as external criterion of change in clinimetric studies was supported.
- The minimum important change was 2.5 points out of 11 of the GPES. Only improvements above this point should be considered as relevant to patients with chronic low back pain undergoing physiotherapy.

Introduction

Patient-reported outcome measures play a prominent role in modern health care [1] and their importance is well recognized by professional bodies [2] and regulatory agencies [3]. They are widely used in clinical practice and research to gather a patient's perspective on the impact of health conditions on their life, or of the effects of specific interventions [4].

Global rating of change scales are a type of generic patient-reported outcome measures commonly used to summarize the global patients' perception of change during or after an intervention. There are several formats of global rating of change scales, but in all of them, the patient must indicate in a single response whether his/her condition has improved or worsened in comparison to a previous anchor point [5]. The "global" nature of the question may reflect the change in specific domains such as pain or disability, or the combinations of multiple domains considered relevant by patients [6,7]. Although these scales do not replace the use of standardized measures for specific domains, the value of the additional information provided from the patient's perspective is widely recognized [8,9]. For these reasons, global rating of change scales were first recommended as an external criterion to test the responsiveness and interpretability of patient-reported outcome measures [10].

The Global Perceived Effect Scale (GPES) described by Costa et al. [11] is an example of a version to measure global perception of change in patients with low back pain. In comparison to other global rating of change scales [12–14], the fact that the health condition is mentioned in the question and presentation of an equal number of points for improvement and worsening (from −5 "vastly worse" to +5 "completely recovered") is important advantages of the GPES [9]. In addition, its 11-point format has been recommended by different authors [8,9] due to the best

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Supplemental data for this article can be accessed here.

compromise between discriminative capacity, reliability, and patient preferences provided by 11-point scales [15].

Three major criticisms have been aimed at the global rating of change scales: (1) Studies regarding its translation and cross-cultural adaptation as well as its psychometric properties are scarce; (2) The fact that global ratings integrate the domains relevant for the patients makes the comparison of its results complex [9]; (3) In addition, its retrospective nature is prone to recall bias. Previous studies have suggested that global rating of change scales scores are influenced by post-intervention status rather than memory of health status prior to intervention, particularly for longer recall periods [5,16]. Therefore, the influence of baseline status to change ratings scores after an intervention should be examine in order to gather evidence to support its use.

To analyze this assumption, Guyatt et al. [17] proposed that baseline scores and the post-intervention scores on a measure of interest (e.g., pain or disability) should have identical but opposite influence on the change rating scores. They support this hypothesis by a mathematical proof and suggested regression models to explore this relationship. Using change rating scores as the dependent variable and post-intervention scores as independent variable, a significant regression coefficient and an additional variance explained are expected when the baseline scores are added to the model. These findings would support the contribution of baseline status and the validity of change rating [17].

This study aims to address this criticism by translating and cross-culturally adapting the GPES into European Portuguese and to investigate its reliability, validity, and responsiveness.

Material and methods

This study was conducted in two phases: the first phase included the translation into European Portuguese and the cultural adaptation of the GPES; the second phase was a validation study to determine the psychometric characteristics of the GPES. The study was approved by the Ethics Committee of the School of Health Care, Institute Polytechnic of Setúbal. All participants provided their written informed consent after receiving information about the study.

Phase 1: translation and cross-cultural adaptation procedure

The English version of GPES described by Costa et al. [11] for patients with low back pain was translated and cross-culturally adapted according to published guidelines [18,19] as follows:

- Translations: Two bi-lingual translators (native Portuguese-speakers – one physiotherapist and one professional English translator) have produced independent translations from the original version of GPES to Portuguese.
- Synthesis of the translations: A single version was produced after discussion and consensus among two translators and research team.
- Back translation: Totally blind to the original question of the GPES, two other translators back-translated the synthesized version of the GPES into the original English language. Both back translators were native English-speakers (one physiotherapist and one professional English translator) and were blinded to the purpose of the translation.
- Expert committee review: An expert committee composed by one methodologist and four health professionals (one Rheumatologist and three Physiotherapists; all with a PhD degree) was formed. The role of the expert committee was to reach consensus, consolidate all versions of the GPES and proposed a pre-final version for field testing.
- Cognitive debriefing: The pre-final version was cognitively debriefed with a sample of native Portuguese patients with chronic low back pain. A convenience sample including patients with heterogeneous clinical and sociodemographic characteristics was recruited from two outpatient clinics (public hospital and academic physiotherapy clinic). Considering that the GPES is composed of only one question, 10 patients were considered appropriate by the expert committee. Patients were interviewed by two researchers in order to assess the comprehensibility and acceptancy of the GPES pre-final version. The completion time and comments about the GPES were recorded. Additionally, alternative formats of the anchor question and response suggested by the expert committee were also assessed. The participants had the opportunity to choose between three options of anchor questions: (1) "Compared to when this episode first started, how would you describe your back at this moment?"; (2) "Compared to the day on which physiotherapy was arranged/referred, how would you describe your back at this moment?"; (3) Compared to the beginning of treatment, how would you describe your back at this moment?." The decision on the final version considered the number of participants who selected each option.

Following field tests and revisions, the final version of the European Portuguese version of the GPES was then agreed upon.

Phase 2: assessment of the psychometric properties

An independent sample of patients with chronic low back pain was used to investigate the test-retest reliability, validity, responsiveness, and interpretability of the Portuguese version of the Global Perceived Effect Scale (GPES-PT). A longitudinal design study with follow-up 48-h later and again at six weeks was conducted between February 2016 and December 2017. Consecutive patients with chronic low back pain were recruited from the waiting list of 12 outpatient clinics from six different regions in Portugal. Local physiotherapists identified potential participants following a standardized recruitment protocol. Participants were considered eligible if they had low back pain for at least three months [20], with or without leg pain, were aged between 18 and 65 years and able to read and speak the Portuguese language. They were excluded if they presented any of the following criteria: specific causes of back pain (fracture, inflammatory disorder, radicular syndrome) [21]; history of back surgery or conservative treatment in the prior 12 and 3 months, respectively; were pregnant or puerperal. Considering that GPES is composed of a single item, the sample size was established according to the minimum criteria required to measure the reliability and interpretability of an instrument adequately. Thus, at least 50 participants for reliability analysis and to define minimum important change were required [22].

At baseline, all patients undergoing a multimodal physiotherapy treatment completed a questionnaire booklet containing sociodemographic and clinical data, the GPES-PT, the Numeric Pain Rating Scale and the Portuguese version of the Quebec Back Pain Disability Scale. Then, 48-h later, with no treatment being given, the GPES-PT and Numeric Pain Rating Scale were completed again for reliability testing. Six weeks after the intervention, GPES-PT was applied together with the Patient Global Improvement Change, the Quebec Back Pain Disability Scale, and the Numeric Pain Rating Scale.

Instruments

The Patient Global Improvement Change Scale is a transition scale designed to evaluate overall change in health status as perceived by patients [23]. The Patient Global Improvement Change Scale ranges from 1 ("no change, or condition has got worse") to 7 ("a great deal better, and a considerable improvement that has made all the difference") and was previously cross-culturally adapted and validated in European Portuguese [12]. Comprehensibility of the Portuguese version of Patient Global Improvement Change Scale was considered good as well as their correlation (Pearson's correlation coefficient = −0.82; $p < 0.01$) with pain intensity (construct validity) [12]. The Numeric Pain Rating Scale is an 11-point self-report outcome measure used to assess the level of pain ranging from "0" (no pain) and "10" (worst possible pain). The Numeric Pain Rating Scale is a very simple to use measure and has shown acceptable psychometric properties in patients with chronic pain [24]. Despite the Portuguese version of Numeric Pain Rating Scale has been not formally adapted and validated yet, the large correlation values obtained between various domain-specific self-report measures such as pain and disability, provide some evidence as to its validity [25–27]. The Quebec Back Pain Disability Scale is a functional disability measurement scale that consists of 20 items representing functional activities in patients with low back pain. Each item ranges from 0 ("not difficult at all") to 5 ("unable to do") and total scores range from 0 (no disability) to 100 (severe disability). The Portuguese version of the Quebec Back Pain Disability Scale has shown good construct validity ($\rho = 0.62$; $p < 0.001$) and test-retest reliability (Intraclass Correlation Coefficient = 0.696), excellent internal consistency (Cronbach's $\alpha = 0.95$) [25], and moderate responsiveness ($\rho = 0.426$; area under the curve = 0.741) [28].

Data analysis

All data analysis was performed using *Statistical Package for the Social Sciences* version 22.0 (IBM, Chicago, IL). A p value <0.05 was considered to indicate statistical significance.

Test-retest reliability. To determine the test-retest reliability, the Intraclass Correlation Coefficient for consistency (two-way random effects model) was calculated in a group of participants who remained unchanged on their pain intensity or improved less than 30% [29], 48 h after the initial assessment. Data of "unchanged group" were then assessed for outliers considering two assumptions: due to "global" nature of GPES-PT, the stability of the construct cannot be fully guaranteed through the absence of changes in pain intensity; and, extreme values in the GPES-PT after 48 h can be related to changes in other unmeasured health domains. For these reasons, values above or below 1.5 times the difference between the 3rd and 1st quartiles were removed [30]. An Intraclass Correlation Coefficient value higher than 0.70 was considered adequate [22].

Validity. The validity of the GPES-PT was assessment in two ways. First, the relation between the GPES-PT and the Patient Global Improvement Change Scale scores after six weeks of intervention was examined (convergent validity) using the Spearman correlation coefficient. It was hypothesized a positive, significant and strong correlation between the scores. The use of post-intervention scores rather than baseline scores to assess convergent validity is supported by transitional nature of the GPES-PT. Then, an important assumption to support the validity of change ratings is their ability to determine a true change over time. So, GPES-PT scores should be based largely on the baseline pain and disability scores rather than post-intervention scores [17].

To test the contribution of baseline status to GPES-PT post-intervention scores, regression equations were used. This analysis was conducted in two stages:

1. Regression analyses were performed using GPES-PT (post-intervention) scores as the dependent variable and post-intervention scores (pain or disability) as independent variable. Next, the baseline scores (pain or disability) were introduced into the regression. In accordance with Guyatt et al. [17], a significant and ideally large proportion of additional variance explained (R^2) by the baseline scores confirmed the influence of baseline scores on GPES-PT [17].
2. Again following Guyatt et al. [17], the validity of change ratings is supported when baseline scores and post-intervention scores apply identical and opposite effects on the GPES-PT scores (dependent variable). This assumed identical variances of baseline and post-intervention scores. The Levene equal variance test was used to assess the difference between the variances. Using two univariate regression models, standardized beta coefficients (SBC) were examined for each independent variable.

Responsiveness and interpretability. Responsiveness is the ability of a patient-reported outcome measures to detect change over time in the construct to be measured [31]. Responsiveness of the GPES-PT was tested in two ways. First, and given the transitional nature of the GPES-PT, responsiveness was examined through the relationship between change scores of the GPES-PT and Patient Global Improvement Change Scale, and between the post-intervention GPES-PT scores and the change scores of the Numeric Pain Rating Scale and Quebec Back Pain Disability Scale, using the Spearman rank-order correlation. The raw change scores for the Numeric Pain Rating Scale and Quebec Back Pain Disability Scale were calculated by subtracting the follow-up scores from the baseline scores. Strength of correlation was interpreted as follows: $r < 0.20$, no association; $r = 0.20$–0.39, weak; $r = 0.40$–0.59, moderate; $r = 0.60$–0.79, strong; and $r = 0.80$–1.0, very strong [32,33]. A positive, significant, and strong correlation between the post-intervention scores of the GPES-PT and the Patient Global Improvement Change Scale ($r > 0.60$) was hypothesized. On the basis of previous research [9,34,35] and because the "global" nature of GPES-PT allows patients to consider other domains beyond pain and disability when determining their overall change, it was hypothesized that the change scores of both instruments (Numeric Pain Rating Scale and Quebec Back Pain Disability Scale) would be moderately correlated with the GPES-PT ($r > 0.41$).

Finally, the ability of the GPES-PT to discriminate between participants who have improved from participants who remained the same was examined using the receiver operating characteristics method. Based on Numeric Pain Rating Scale and Patient Global Improvement Change Scale cutoff points of a post-intervention improvement of ≥30% in the Numeric Pain Rating Scale [29] or ≥5 in the Patient Global Improvement Change Scale [28], participants were classified as "clinically improved." The remaining participants were classified as "unchanged"/"clinically stable." Based on these criteria, receiver operating characteristics curves were created by plotting the false positive rate (1-specificity) against the true positive rate (sensitivity). The area under the curve was estimated using the nonparametric method and was interpreted as the probability of correctly discriminating between groups [36]. An area under the curve of at least 0.7 is considered adequate [22]. It was hypothesized that GPES-PT has an adequate ability to discriminate between participants who have improved from

participants who were unchanged. The minimum important change for both anchors was calculated as the optimal cutoff point on the receiver operating characteristics curve that best fits the sensitivity and specificity [37].

Results

Translation and cross-cultural adaptation

The translation process was performed without any major difficulties. Of the 10 patients in the field test, 7 (70%) were women and 3 (30%) were men. Their mean age was 52.1 (±7.5) years (ranged 39–60). Half the patients had basic/primary education and only two had university education. Eight patients were active workers but three of them had missed work (at least one time) in the past year due to low back pain. Most of the patients had back pain for more than 24 months (70%), did not report radiating pain (60%) or take medication for low back pain (80%). The current pain intensity was 4.0 (±1.5) points (ranged 1–6) on the Numeric Pain Rating Scale.

In general, the majority of the patients interviewed considered the question clear and easily understandable, but the term "episode" was considered confusing by four participants. For example, one patient reported that "seems to refer to the first time I had back pain" while another suggested change to "Comparing with the last pain flare up ...." Due to the long pain duration in patients with chronic low back pain, the expert committee anticipated this eventuality. Thus, participants had the opportunity to choose between alternative questions. Taking into account the participants' choices (6 of the 10 participants selected the same option), the original question ("Compared to when this episode first started, how would you describe your back these days?") was changed to: "Compared to the day on which physiotherapy was arranged/referred, how would you describe your back at this moment?" The final version of the GPES-PT is provided in Supplementary Figure S1.

Psychometric properties study

Of the 109 participants enrolled in the study, 91 (83.5%) completed the second assessment (48 h later) and 84 (77.1%) completed the evaluation six weeks after the intervention. Of the 25 participants who failed follow-up evaluations, 19 discontinued their treatment and 6 did not complete the outcome measures adequately. These participants showed similar sociodemographic and clinical characteristics of those who complete the intervention (Table 1). Fifty-six of the 84 participants were considered "stable" (improvement <30% and not increased pain) and therefore were included in the test-retest reliability analysis (see Figure 1). Reliability analysis included only 50 participants as six cases were

Table 1. Sociodemographic and clinical characteristics of participants.

Variables	Total sample ($n = 109$)	Patients completing the intervention ($n = 84$)	Dropouts ($n = 25$)
Age[a]	47.4 ± 10.8	47.8 ± 11.1	46.2 ± 10.1
Gender [*N* (%)]			
Male	22 (20.2%)	20 (23.8%)	2 (8%)
Female	87 (79.8%)	64 (76.2%)	23 (92%)
Educational level [*N* (%)]			
Primary education	11 (10.1%)	8 (9.5%)	3 (12%)
Basic education	26 (23.9%)	20 (23.8%)	6 (24%)
High school	29 (26.6%)	20 (23.8%)	8 (32%)
College	43 (39.4%)	36 (42.9%)	8 (32%)
Working status [*N* (%)]			
Employed	89 (81.7%)	70 (83.3%)	19 (76%)
Other	20 (18.3%)	14 (16.6%)	6 (14%)
Duration of pain [*N* (%)]			
3–6 months	13 (11.9%)	10 (11.9%)	3 (12%)
6–12 months	12 (11%)	8 (9.5%)	4 (16%)
12–24 months	10 (9.2%)	6 (7.1%)	4 (16%)
>24 months	74 (67.9%)	60 (71.4%)	14 (56%)
Pain irradiation [*N* (%)]			
Yes	69 (63.3%)	52 (61.9%)	16 (64%)
No	40 (36.7%)	32 (38.1%)	9 (36%)
Medication [*N* (%)]			
Yes	37 (33.9%)	27 (32.2%)	10 (40%)
No	72 (66.1%)	57 (67.8%)	15 (60%)
Pain intensity (0–10 NPRS)[a]	4.9 ± 2.5	4.8 ± 2.4	5.5 ± 2.5
Disability (0–100 QBPDS)[a]	30.3 ± 17.9	29.1 ± 18.1	34.0 ± 17

[a]Mean ± SD.
NPRS: Numeric Pain Rating Scale; QBPDS: Quebec Back Pain Disability Scale.

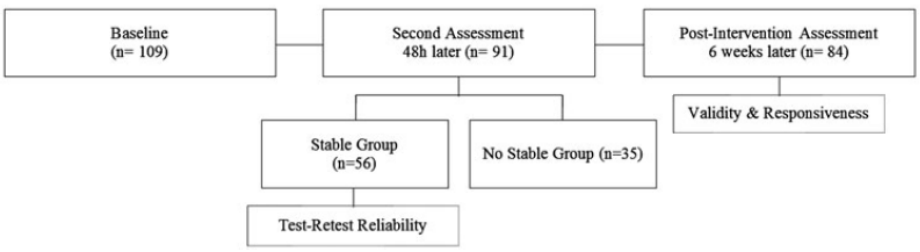

Figure 1. Data collection flowchart.

considered outliers and therefore removed from analysis. Data from 84 participants were considered for responsiveness analysis.

Reliability

The Intraclass Correlation Coefficient of GPES-PT was 0.758 (95% CI 0.698–0.855), indicating adequate test-retest reliability of the scale.

Validity

The GPES-PT score showed a significantly and strong correlation with the Patient Global Improvement Change Scale score ($r = 0.677$; $p = 0.001$), supporting its convergent validity. Tables 2 and 3 show the contribution of baseline scores to GPES-PT scores via regression analyses. The inclusion of the baseline scores in the model increased the R^2 values substantially (0.161 and 0.211), indicating their relevance for determining the GPES-PT score. From the univariate regression models, the SBC did not show the ideal patterns as described by Guyatt et al. [17]. However, the magnitude of the baseline scores coefficients was larger than that for the post-interventions scores and significantly associated with the GPES-PT scores.

Table 2. Regression models – R^2 with post and pre scores into the model.

	R^2 with post-scores into the model	R^2 after entering the pre scores into the model	Additional R^2
NPRS	0.037	0.198	16.1%
QBPDS-PT	0.001	0.212	21.1%

NPRS: Numeric Pain Rating Scale; QBPDS: Quebec Back Pain Disability Scale.

Table 3. SBC for GPES-PT and baseline/post-intervention scores (pain and disability).

	Pain		Disability	
	SBC	p Value for difference in variance**	SBC	p Value for difference in variance**
Baseline	0.284*	0.002	0.376*	0.173
Post-intervention	−0.192		−0.03	

*$p < 0.05$.
**Determined with Levene equal variance test.

Responsiveness

As hypothesized, the change scores of the GPES-PT correlated strongly with the Patient Global Improvement Change Scale scores (0.601, $p < 0.01$). Moderate, but significant correlations ($p < 0.01$) were found between post-intervention GPES-PT scores and both the Quebec Back Pain Disability Scale and Numeric Pain Rating Scale changes (0.452 and 0.457, respectively). The area under the curve, minimum important change and their sensitivity and specificity values obtained through the receiver operating characteristics curve method (Figure 2) are shown in Table 4. All the formulated *a priori* hypotheses were confirmed.

Discussion

The aims of the present study were to cross-culturally adapt the GPES into Portuguese and to examine its psychometric properties. The process of translation and cross-cultural adaptation was conducted without major difficulties and a new formulation of the anchor question was adopted according to participants' choice. The final version of GPES-PT includes the term "back" in the question while its 11-point format allows a neutral response and equal number of options for improvement and worsening. These characteristics represent important advantages over other versions such as Portuguese version of Patient Global Improvement Change Scale [12]. First, it ensures that the patient provides information about the health condition of interest to the clinician or researcher; then, the patient is not induced to rate his/her improvement as positive in the absence of response options for worsening.

The GPES-PT showed adequate test-rest reliability (Intraclass Correlation Coefficient =0.758). This value is lower than those

Table 4. AUC and MIC for GPES-PT.

Criteria	AUC	p Value	CI 95%	MIC	Sensitivity	Specificity
≥30% NPRS	0.716	0.001	0.607–0.825	2.5	63.3%	65.6%
≥5 PGIC-PT	0.836	0.001	0.749–922	2.5	67.2%	88.5%

AUC: Area under the curve; MIC: Minimum important change; NPRS: Numeric Pain Rating Scale; PGIC-PT: Patient Global Improvement Change Scale.

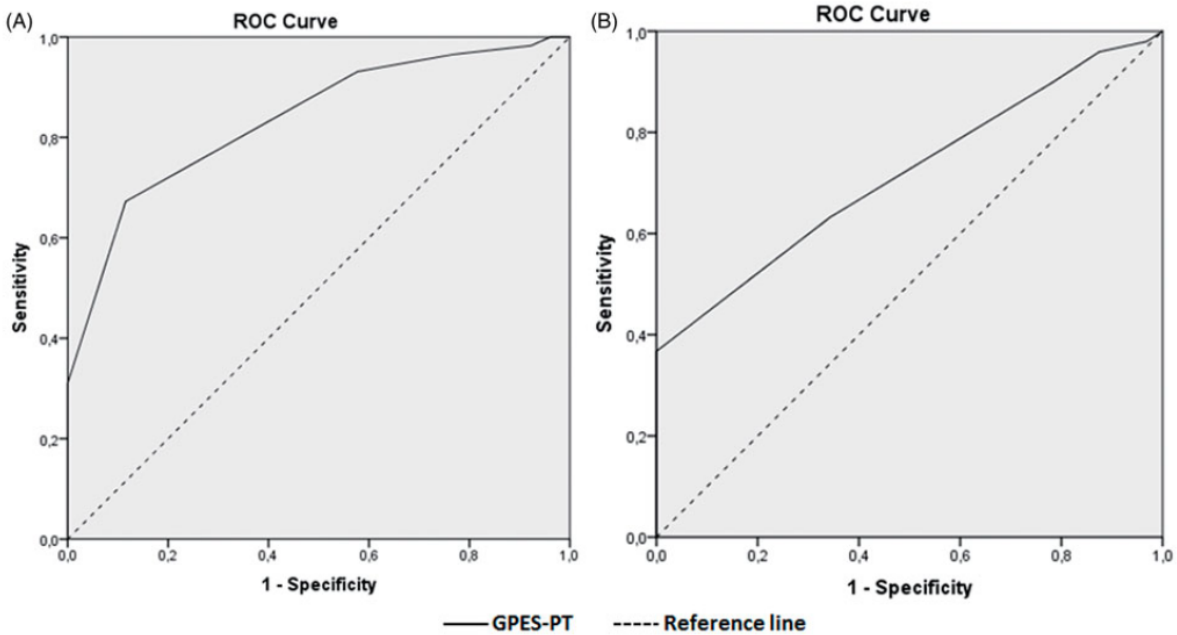

Figure 2. Receiver operating characteristics analysis of the GPES-PT, based on the change in the Patient Global Improvement Change Scale (graphic A) and Numeric Pain Rating Scale scores (graphic B).

observed in previous studies, which ranged from 0.90 to 0.99 (11,16). This difference in the Intraclass Correlation Coefficient might partly be explained due to the short-time interval (30 min to 24 h) used in the preview studies. The longer interval time used in our study reduces the chances of a recall bias but increases the possibility of a change in the measured construct. Moreover, the global perception of change is a complex and unstable construct that can be influenced by multiple contextual and health-related aspects of patients [34,35]. For this reason, it was more difficult to define the "stable group" for test-rest reliability analysis, and therefore, a lower Intraclass Correlation Coefficients would be expected. In turn, most patients have long-term low back pain and marked symptoms fluctuations within 48 h are not expected. This issue needs to be addressed in future studies in order to clarify the influence of time interval and health condition in test-retest reliability of global rating of change scales.

For the validity analysis, the Patient Global Improvement Change Scale and GPES-PT were used. As previously hypothesized, the scores of the two measures were significantly and strongly related after the intervention (convergent validity). In addition, the contribution of the baseline status to the GPES-PT scores after the intervention was analyzed. The analyses of additional R^2 when pain or disability scores at baseline are introduced into the regression models (16.1% and 21.1%) seem to support the validity of the GPES-PT. The absence of reference values makes the interpretation of these results complex. However, explained variance values were substantially greater when compared with those reported by previous studies (0–3%) that have questioned the validity of the GPES [5,16]. In relation to the analysis of the SBC, the expected equal and opposite pattern was only observed for pain intensity. This result shows that higher pain scores at baseline and lower pain scores after intervention predict higher GPES scores. Interestingly, the baseline beta values were higher in magnitude (and significant) than post-intervention beta values indicating the contribution of the pain and disability at the baseline to the GPES. Despite the fact that previous studies reported that GPES scores are influenced by the current state [5,16], our findings support its validity at least in the short term (six weeks) and its use as an external criterion of change in clinimetric studies.

All the *a priori* hypotheses formulated for the relationship between change scores of the GPES-PT and Patient Global Improvement Change Scale, and between the post-intervention GPES-PT scores and the change scores of the Numeric Pain Rating Scale and Quebec Back Pain Disability Scale, were confirmed. The absence of psychometric studies regarding GPES's responsiveness limits the discussion of these results. This study's results also confirmed the discriminative capacity of the GPES-PT. Area under the curve values of 0.71 for Numeric Pain Rating Scale criteria and 0.83 for Patient Global Improvement Change Scale criteria were found, indicating an adequate ability of the GPES-PT to discriminate between "stable" and "improvement" groups. Unlike the Numeric Pain Rating Scale, the Patient Global Improvement Change Scale measures the same construct as the GPES-PT. Therefore, the highest area under the curve value for Patient Global Improvement Change Scale criteria was expected. The receiver operating characteristics method also revealed an absolute optimal cutoff (minimum important change) of 2.5 points on the GPES-PT for both anchor criteria. This value indicates that only a change equal to or greater than 2.5 points out of 11 of the GPES-PT should reflect a relevant improvement from the intervention perceived by the patient. Despite the wide use of the GPES in the definition of clinical improvement, its cutoff points have been defined arbitrarily and no study defining a minimum important change on GPES in a chronic low back pain sample was found. Kamper et al. [9] reported that a change of at least two points is likely considered a clinically meaningful change. Therefore, the value found in this study using appropriate statistical methods is in line with those used in previous studies.

Some limitations should be addressed in interpreting these results. First, the assumption of equal variance was not satisfied for pain scores as established by the mathematical proof described by Guyatt et al. [17]. Thus, results on the contribution of pain scores from baseline to GPES-PT should be interpreted with caution. Second, it has been suggested that an external criterion for minimum important change calculation is valid when having an association above 0.5 with the assessed scale [17,38]. Consequently, one limitation to be considered is the fact that this criterion was not met for the pain measure. This is also relevant in the interpretation of test-retest reliability values. Because pain intensity changes were used to define the "stable group," the lower Intraclass Correlation Coefficients found may partly be explained by the poor relationship between these two constructs. Therefore, future studies need to address these issues, using other external criteria (beyond pain intensity) in the reliability and responsiveness analysis.

The main strengths of this study are the consideration of the patients' perspective in the definition of the final version of GPES-PT and the examination of the psychometric properties of a global rating of change scale in a specific sample. Considering its simplicity but adequate psychometric properties, GPES-PT can be an important tool for clinical practice and research in patients with chronic low back pain. Accordingly, their use in clinimetric studies as an external criterion of change appears to be supported at least when the transition period is short (six weeks).

Conclusion

The GPES was successfully cross-culturally adapted into a European Portuguese version. The GPES-PT is a simple and comprehensible measure and demonstrated an adequate reliability, validity, and responsiveness. Therefore, this instrument can be used to measure global perception of change in patients with chronic low back pain. Clinicians can be confident that a 2.5-point change on the GPES-PT in patients with chronic low back pain represents a clinically meaningful change.

Disclosure statement

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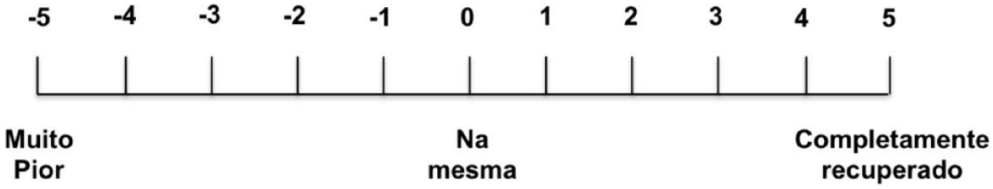
Supplemental material

Global Perceived Effect Scale - European Portuguese version

Comparativamente com o dia em que marcou/ foi referido para a fisioterapia, como descreve as suas costas **atualmente**?



5.3. Study 3 - The role of pain and disability changes after physiotherapy treatment on global perception of improvement in patients with chronic low back pain

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Original article

The role of pain and disability changes after physiotherapy treatment on global perception of improvement in patients with chronic low back pain

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ABSTRACT

Background: The effectiveness of physiotherapy in patients with chronic low back pain is usually measured through changes in pain and disability domains. However, recent research has suggested that these two domains are not sufficient to capture all the physiotherapy benefits when patients' perspective is considered.
Objective: The aim of this study was to investigate the role of pain and disability changes in explaining the global perception of improvement in patients with chronic low back pain undergoing physiotherapy.
Design: Prospective cohort study.
Methods: The study was conducted on183 patients who were referred to physiotherapy treatment due to low back pain lasting more than 12 weeks. Sociodemographic and clinical characteristics were measured at baseline, together with pain intensity and disability. Eight (post-intervention) and twelve weeks later, global perception of improvement was measured together with pain and disability. The Pearson correlation coefficient and linear regression models were used for analyses.
Results: Of the 183 participants included, 144 completed the 12-weeks follow-up. Significant and moderate correlation was found between pain and disability changes and the global perception of improvement after intervention and at the 12-weeks follow-up. Pain and disability changes explained 20.7%–36.3% of the variance in the global perception of improvement.
Conclusions: Pain and disability changes are related and contributed to explaining a partial proportion of variance in the global perception of improvement. The findings suggest that these domains are not sufficient to explain and measure all of the benefits of physiotherapy when patients' global perception of improvement is considered.

1. Introduction

Chronic low back pain (CLBP) is one of the most prevalent health conditions worldwide (Meucci et al., 2015). In addition to the impact at the individual level, the large economic and social costs related to CLBP are well documented in the literature (Gouveia et al., 2016; March et al, 2014; Parthan et al., 2006). Subsequently, an increased research effort has been observed in order to understand the associated factors and the most effective interventions for this health condition (Wand and O'Connell, 2008). Physiotherapy modalities are recommended for patients with CLBP (Foster et al., 2018; National Institute for Health and Care Excellence, 2016) and the evidence on this topic has accompanied a global effort of all health research.

An important part of an effective research process is the selection of appropriate outcome domains (Williamson et al., 2012). This is critical to compare and quantify the benefits (or adverse effects) associated with the applied interventions as well as to promote evidence-informed practice (Gargon et al., 2014). Physiotherapy studies on CLBP frequently measure pain and disability domains (Pires et al., 2020). A recent systematic review identified the outcome domains reported in 195 randomized controlled trials examining physiotherapy interventions for patients with CLBP (Pires et al., 2020). This review found

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that pain intensity and disability were used in 85% of the included studies and were the most frequent primary outcomes. Others common domains such as spine mobility and health-related quality of life were used in less than 30% of the studies (Pires et al., 2020). Therefore, pain and disability are the only domains used in a large proportion of studies.

Despite the dominance of pain and disability on outcomes assessment of patients with CLBP, preliminary evidence from qualitative studies supports that they are not sufficient when patients' perspective is considered. Hush et al. (2009) developed a qualitative study with 36 patients that recovered or did not recover from low back pain. The authors found a discrepancy between pain and disability scores and the perspective of self-reported recovery by patients suggesting the relevance of others domains (Hush et al., 2009). More recently, others studies have reinforced this view supporting a potential discord between outcome domains based on the health professional perspective and the effects of intervention that are meaningful to the patients (Gardner et al., 2015; Sanderson et al., 2010).

Consequently, patients' global perception of improvement measures have been progressively introduced into chronic pain research (Dworkin et al., 2005). These measures provide reliable information about patients' perspective on the intervention's benefits helping to interpret if changes in specific outcome domains such as pain or disability were meaningful to patients (Dworkin et al., 2008; Kamper et al., 2010b). At this point, there is a lack of quantitative studies analysing the relationship between pain and disability changes with patients' global perceptions of improvement. This knowledge may contribute to clarifying the extent to which the pain and disability domains are sufficient (or not) to analyse the effectiveness of physiotherapy considering the patients' perspective of improvement. The aim of this study was to analyse the role of pain and disability changes in explaining global perception of improvement in patients with chronic low back pain undergoing physiotherapy.

2. Methods

2.1. Study design and setting

A prospective cohort study with a 12-week follow-up was undertaken in patients seeking physiotherapy treatments for nonspecific CLBP. Between October 2015 and December 2018, potential participants were identified and recruited consecutively from 20 different outpatient clinics in Portugal. A standardized protocol was followed by local physicians and/or physiotherapists in the recruitment process. The minimum sample size required was previously established using formula $N > 50 + 8\,m$ (where m is the number of independent variables) (Green, 1991). In this study, eight clinical and demographic variables were considered in addition to pain and disability changes. A potential loss of 20% of participants during the study was also considered. Accordingly, a minimum of 156 participants was required. All participants received oral and written information about the study and provided their informed consent prior to participating.

2.2. Participants

Inclusion criteria for this study were: patients aged 18 to 65 with nonspecific low back pain with at least 12 weeks duration (Airaksinen et al., 2006), with or without leg pain, pain intensity ≥3 (measured by the Numeric Pain Rating Scale) on the day of the initial evaluation, and literate in Portuguese. Patients with clinical signs of serious or specific pathologies (inflammatory disorder, fracture, radicular syndrome) (Smeets et al., 2006), pregnancy, and history of back surgery or conservative treatment in the prior 12 and 3 months, respectively, were excluded. Eligibility was checked by local physiotherapists.

2.3. Intervention

All participants received usual care in physiotherapy, without any restriction from the research team. Although a comprehensive definition of physiotherapy treatments was provided (manual therapy; therapeutic education; therapeutic exercise; electrotherapy and physical agents), the type of treatments used and the number of sessions were the responsibility of physiotherapists. Usual care was chosen in order to reflect current practice and promote the variability of the treatments applied. Therefore, the characteristics of the intervention applied were not under analysis and it was assumed that the variability of treatments washed out specific treatment modifier effects (Kent et al., 2010). The duration of the intervention, the number of participants who did not complete the intervention and their reasons were recorded.

2.4. Instruments

Participants were assessed at baseline, 8 weeks after the beginning of the intervention (or earlier if they were discharged) and at the 12-week follow-up. At baseline, participants were asked to complete a sociodemographic and clinical questionnaire (see Table 1) along with the Numeric Pain Rating Scale (NPRS) and the Quebec Back Pain Disability Scale (QBPDS-PT) (Cruz et al., 2013). The Global Perceived Effect Scale (GPES-PT) (Freitas et al., 2019) was used to assess the patients' global perception of improvement. Eight and twelve weeks later, GPES-PT was applied together with NPRS and QBPDS-PT. GPES-PT is a transition scale ranging from −5 ("vastly worse") to +5 ("completely recovered"). This measure was previously translated and cross-culturally adapted in European Portuguese showing adequate convergent validity ($r = 0.677$), test-retest reliability (ICC = 0.758), and responsiveness (Areas under the curve values of 0.71 and 0.83) (Freitas et al., 2019). To assess the average level of pain intensity, the NPRS was used. The NPRS is an 11-point self-report measure (0–10) with the labels "no pain" and "worst imaginable pain" on the ends that has proven to be valid and reliable in patients with chronic pain (Farrar et al., 2001). Functional disability was assessed using QBPDS-PT. This questionnaire consists of 20 items representing functional activities with 6 response categories each (0- "not difficult at all" to 5- "unable to do"). The total score is calculated by a summation of the scores for each individual item ranging from 0 (no disability) to 100 (severe disability). The QBPDS-PT has shown good validity ($\rho = 0.62$), test-retest reliability (ICC = 0.696) and internal

Table 1
Baseline characteristics of the participants.

Variables	Total Sample (n = 183)
Age[a]	48.02 ± 10.53
BMI (kg/m^2)[a]	26.18 ± 4.28
Gender [N (%)]	
Male	36 (19.7%)
Female	147 (80.3%)
Educational level [n (%)]	
Primary/Basic education	74 (40.4%)
High school/ College	109 (59.6%)
Working status [n (%)]	
Employed	152 (83.1%)
Not Active	31 (16.9%)
Duration of pain [n (%)]	
3–24 months	58 (31.7%)
>24 months	125 (68.3%)
Pain Irradiation [n (%)]	
Yes	121 (66.1%)
No	61 (33.3%)
Medication [n (%)]	
Yes	85 (46.4%)
No	98 (53.6%)
Pain Intensity (0–10 NPRS)[a]	5.86 ± 1.88
Disability (0–100 QBPDS)[a]	36.54 ± 17.78

[a] (mean ± SD).

consistency (Cronbach's α = 0.95) (Cruz et al., 2013).

2.5. Data analysis

Descriptive statistics was used to summarize participants' characteristics at baseline. To compare the characteristics between participants who completed and did not completed the study, the chi-square test or Mann-Whitney *U*-test were used. All variables were assessed for normality and outliers. Absolute change in pain and disability were computed by subtracting baseline scores from post-intervention and 12 weeks follow-up scores. Thus, positive changes indicated improvement, while negative changes indicated worsening. Based on absolute changes and baseline scores, the percentage change was calculated. Pearson correlation coefficient was performed to quantify the association between the GPES scores and pain and disability changes. The correlation coefficients were interpreted as follows: r < 0.10, no association; r = 0.10–0.39, weak; r = 0.40–0.69, moderate; r = 0.70–0.89, strong; and r = 0.90–1.0, very strong (Schober and Schwarte, 2018).

Linear regression models were preformed to investigate the association of changes in pain and disability (independent variables) in relation to the GPES scores (dependent variable). Previously, a univariate linear regression was conducted between each baseline variable (clinical and sociodemographic characteristics) and the dependent variable. Baseline variables with a p value ≤ 0.2 were then entered in all multivariate regression models as covariates. After that, multivariate models were performed (method: forward stepwise) according to a predefined sequence of steps. First, the absolute changes in pain were entered alone into the regression equation. Second, the same was performed for the absolute changes in disability (without the presence of absolute changes in pain). Third, the absolute changes in pain and disability were entered together into the regression equation. To quantify the variance in the dependent variable (GPES) attributable to the pain and disability variance, the R^2 was recorded in each step of the analysis. In addition, the relative importance of predictors was used to understand the contribution of each independent variable in the regression equation (Tonidandel and LeBreton, 2011). The same analysis was repeated for the percentage changes after the intervention and at the 12-week follow-up. Variance inflation factors (VIF) were used to check multicollinearity. VIFs greater than 10 were considered indicative of serious multicollinearity problems. Data analysis was performed using SPSS (version 24.0; IBM, Chicago, IL). A significance level of 0.05 was chosen for this study.

3. Results

3.1. Participants

Of the 235 potential participants identified, 183 participants with CLBP were considered eligible and accepted to participate in this study. Of those, 173 (94.5%) completed the physiotherapy treatment and 144 (78.7%) completed the follow-up at 12 weeks. A study flowchart and reasons for dropouts are described in Fig. 1. Table 1 describes the characteristics of all participants assessed at baseline. Participants who failed follow-up evaluations differ from those that did not fail in pain

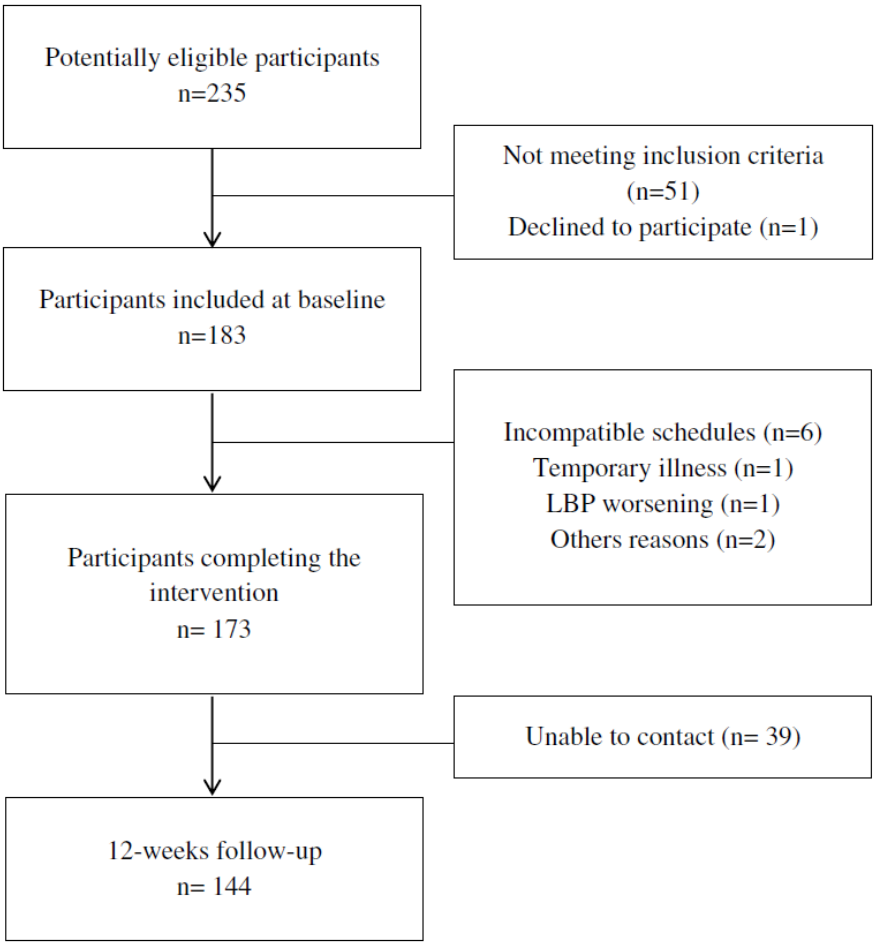

Fig. 1. Study flow-chart.

Table 2
Mean scores of GPES and changes from baseline in pain intensity and disability.

	GPES Scores	Absolute Changes		Percentage Changes	
		Pain	Disability	Pain	Disability
Post-intervention	3.02 ± 1.30	2.56 ± 2.48	13.63 ± 16.90	41.73 ± 45.82	36.03 ± 38.99
12-Weeks follow-up	2.71 ± 1.74	2.04 ± 2.58	10.68 ± 17.41	33.72 ± 46.91	24.87 ± 50.69

Table 3
Correlation between GPES scores and changes in pain and disability.

	Absolute Changes		Percentage Changes	
	Pain	Disability	Pain	Disability
Post-intervention GPES scores	0.44	0.51	0.48	0.55
12-Weeks follow-up GPES scores	0.27	0.41	0.28	0.39

*All correlations were significant ($p < 0.01$).

intensity ($p = 0.009$), irradiated pain ($p = 0.042$) and medication use ($p = 0.033$). Significant differences in other variables evaluated at the baseline were not found. The mean scores for changes in pain and disability measures as well as the GPES mean scores after the intervention and at the 12-week follow up are presented in Table 2.

3.2. Correlations analysis

Pearson correlations between the GPES scores and improvements in pain and disability are outlined in Table 3. All correlations were statistically significant ($p < 0.001$), weak to moderate (r ranging from 0.27 to 0.55) and positive.

3.3. Linear regression analysis

The explained variance for the GPES scores in the full regression model ranged between 14.4% and 37.4% (Tables 4 and 5). A maximal explained variance was obtained when percentage changes in pain and disability were analysed together. Partial regression models with pain or disability separately, suggest a greater contribution of disability changes to the GPES when compared to pain intensity improvement (Tables 4 and 5). The same results were observed for the relative importance values. Regression models after the intervention and including change scores in percentage obtained higher values of variance. The VIFs were less than 2 in all models indicating an absence of multicollinearity problems.

Table 4
Linear regression results examining contributions of post-intervention changes in pain and disability to GPES scores.

	Independent Variables entered in the model	Adjust R^2	Predictors relative importance	*p*
Using Absolute Changes				
1st	Δ Pain	0.194	1.0	0.001
step	Δ Pain[a]	0.219	0.88	0.001
2nd	Δ Disability	0.253	1.0	0.001
step	Δ Disability[a]	0.264	0.94	0.001
3rd	Δ Pain	0.306	0.33	0.001
step	Δ Disability		0.67	0.001
	Δ Pain	0.322	0.33	0.001
	Δ Disability[a]		0.57	0.001
Using Percentage Changes				
1st	Δ Pain	0.225	1.0	0.001
step	Δ Pain[a]	0.245	0.90	0.001
2nd	Δ Disability	0.293	1.0	0.001
step	Δ Disability[a]	0.301	0.96	0.001
3rd	Δ Pain	0.363	0.34	0.001
step	Δ Disability		0.66	0.001
	Δ Pain	0.374	0.34	0.001
	Δ Disability[a]		0.59	0.001

[a] Adjusted to baseline variables (BMI; working status; educational level).

Table 5
Linear regression results examining contributions of 12-Weeks follow-up changes in pain and disability to GPES scores.

	Independent Variables entered in the model	Adjust R^2	Predictors relative importance	*p*
Using Absolute Changes				
1st	Δ Pain	0.144	1.0	0.001
step	Δ Pain[a]	0.145	0.95	0.001
2nd	Δ Disability	0.179	1.0	0.001
step	Δ Disability[a]	0.179	0.97	0.001
3rd	Δ Pain	0.207	0.33	0.015
step	Δ Disability		0.67	0.001
	Δ Pain	0.207	0.33	0.015
	Δ Disability[a]		0.67	0.001
Using Percentage Changes				
1st	Δ Pain	0.160	1.0	0.001
step	Δ Pain[a]	0.160	1.0	0.001
2nd	Δ Disability	0.184	1.0	0.001
step	Δ Disability[a]	0.184	1.0	0.001
3rd	Δ Pain	0.222	0.39	0.006
step	Δ Disability		0.61	0.001
	Δ Pain	0.222	0.39	0.006
	Δ Disability[a]		0.61	0.001

[a] Adjusted to baseline variables (Age).

4. Discussion

In the present study, the role of pain and disability changes in accounting for the global perception of improvement in patients with CLBP undergoing physiotherapy was analysed. The main findings are that the pain intensity and disability changes during the intervention demonstrated a modest contribution to the GPES scores. Despite the independent and significant associations, pain intensity and disability changes accounted for a small proportion of total GPES variance even when considered together. In addition, correlations between pain and disability changes with the GPES scores were mostly close to or less than 0.5. These data suggest that these domains represent different constructs and greater changes in pain and disability may not necessarily mean higher levels of perceived improvement.

Changes in pain and disability explained up to 36.3% of the variance in the GPES scores in this study. Although a complete accounting of the global perception of improvement is not expected, a large proportion of variance remains unexplained. The role of other benefits of interventions, not assessed in this study, may help to explain these findings. Previous studies that included chronic pain patients have demonstrated significant associations of changes in other domains such as fatigue (Hudson et al., 2009), sleep (Geisser et al., 2010), work (Hudson et al., 2009), depression (Geisser et al., 2010; Scott and McCracken, 2015) or social function (Scott and McCracken, 2015) with the global perception of improvement. Scott and McCracken (2015) reported that perceived changes in pain, mood and physical, social, and work-related activities explained 64% of the variance in Patient Global Impression of Change. These values of variance are substantially higher than those found in this study. Qualitative studies have also reported similar findings. Hush et al. (2009) reported that perception of recovery

is mediated by patients' appraisal of their function and pain intensity but they are not a reliable indicator of recovery. Accordingly, other authors have suggested that global perception of improvement may incorporate a variety of other domains such as self-efficacy, self-esteem, spontaneity or "feeling positive emotions" (Evans et al., 2014; Walton, 2013). This set of domains fits in the mental health area and can be particularly important in patients' adaptation and readjustment to the health condition. This point of view and the way these intervention benefits seem to contribute to the perception of improvement have been described in previous studies (Beaton et al., 2001; Walton, 2013). Therefore, there appears to be reason to anticipate that the evaluation of other variables potentially modifiable by physiotherapy interventions could contribute to a better understanding of the GPES scores.

Pain is the most common symptom of CLBP and an important baseline predictor for the intervention success (Cecchi et al., 2014; Verkerk et al., 2013). Interestingly, a greater association and contribution of disability changes to GPES scores in relation to pain intensity changes was consistently identified in this study. The highest relative importance values for disability changes (ranging from 0.61 to 0.67) compared to those observed for changes in pain intensity (ranging from 0.33 to 0.39) also supports this assumption. Several reasons for these findings can be discussed. Firstly, chronic pain patients may not expect a complete resolution of their pain condition (Evans et al., 2014). Thus, the importance attributed by patients to improvements in other variables such as disability may be greater than improvements in pain. The secondary role of pain in patients with CLBP was also demonstrated in the study conducted by Kamper et al. (2010a). They found that pain improvements accurately identified patients with acute low back pain who perceive a complete recovery. However, the odd ratios values representing this relationship were substantially lower in patients with CLBP (Kamper et al., 2010a). Secondly, recent studies have demonstrated early pain changes in the intervention and its predictive value for success in others variables after the intervention (Cook et al., 2017; Mansell et al., 2017). Therefore, pain changes may act as facilitators for the disability changes that are more easily perceived as important by the patients after the intervention. Finally, the type of instrument used to measure pain (unidimensional scale) and disability (multi-item scale) may not be irrelevant to the observed results. Considering the complexity of pain experience, limited information can be captured using a single and unidimensional measure such as the NPRS. In contrast, the QBPDS includes a variety of functional activities more easily understood by the patients and representatives of their daily restrictions due to pain. This may also help to explain why disability is better related to global perception of improvement.

In addition to the reasons described above, the role of the intervention adopted in this study should not be underestimated. The influence of the type of intervention and its goals in the domains with the greatest contribution to the global perception of improvement scales has been reported. Geisser et al. (2010) found that pain changes were the main contributor when fibromyalgia patients assessed the perceived benefits with pharmacological treatment. In contrast, changes in mood, acceptance and daily functioning were the most important variables after a psychological programme in the study with chronic pain patients developed by Scott and McCracken (2015). In this study, disability changes present more relevance than pain for the GPES scores suggesting that physiotherapy modalities may have a particular impact on reducing disability perceived by patients. Furthermore, different interventions presented different potential benefits and so the contribution of specific domains to the GPES scores can diverge according to the interventions applied. Looking at the results of this study, they suggest that patients with CLBP undergoing physiotherapy perceive benefits in other domains beyond pain and disability.

Overall, the strength of the associations and the contribution of the independent variables to the GPES scores decreased at the 12-week follow-up. Based on previous studies, these results could be due to recall bias associated to the GPES scale (Kamper et al., 2010b). In fact, different authors have questioned the patients' ability to accurately consider their previous health state when they evaluate the change after long periods of time (Kamper et al., 2010b, 2009). Therefore, the GPES scores at the 12-week follow-up could have been influenced by current pain and disability rather than by the changes that have occurred since the beginning of the intervention. However, this is not the only hypothesis to consider. Over time, patients tend to adapt to the pain condition and adjust their life to minimize its impact. Consequently, other health domains can be valued after the intervention, modifying the importance attributed by patients to pain and disability changes and thus their contribution to the GPES scores. This hypothesis has been argued in other studies (Beaton et al., 2001; Rampakakis et al., 2015).

The effectiveness of the interventions is usually analysed and interpreted considering the absolute values or absolute changes occurring in the various outcome domains. In this study, the analyses using percentage changes showing higher values of correlation coefficients and variance explained the GPES scores. The fact that the percentage changes take into account baseline scores seems to justify these findings (Dworkin et al., 2008; Ostelo et al., 2008). For example, 30 points of pain reduction may represent a complete recovery but also an unsatisfactory change for patients with high baseline levels of pain. Therefore, the analysis of percentage changes should be considered in clinical trials in order to improve the interpretation of the intervention results.

The use of pain intensity and disability to assess the effectiveness of physiotherapy in patients with CLBP has prevailed in recent physiotherapy trials (Pires et al., 2020). These two domains seem to be considered by physiotherapists and researchers as the most important and other outcome domains are rarely used (Pires et al., 2020). The data from this study suggest that the perspective of patients with CLBP and researchers may not be completely aligned and some potential benefits of physiotherapy beyond pain and disability are not being measured. This underrepresentation of patient-centred domains can reduce the validity of the outcome measurement process and should be addressed in future studies. Understanding the perceived benefits by patients with CLBP after physiotherapy can be an important step towards a suitable and valid outcome evaluation.

The knowledge about the importance of pain and disability changes to patients with CLBP undergoing physiotherapy is limited. This study addresses this gap and the findings may have important implications for the way the effectiveness of physiotherapy is measured. Together with the appropriate sample size and variability of recruitment settings (external validity), these were the main strengths of this study. However, some limitations need to be considered. First, a significant proportion of participants failed to attend the 12-week follow-up evaluation. A higher proportion of these participants reported irradiated pain and medication use as well as higher levels of pain intensity at baseline when compared to participants who completed the study. For this reason, the relationship between unavailability to complete the study and worse outcomes after the intervention cannot be excluded. Second, more than 80% of the participants were women. Although the reasons for this difference are unknown, the findings of this study must be interpreted in the light of this limitation. Third, physiotherapy outcomes (or other intervention) are influenced by multiple contextual factors and other sources of bias (e.g. natural course of LBP; patient's expectations) that cannot be controlled through an observational study design (Testa and Rossettini, 2016). Future studies using more robust analyses (e.g. mediation analysis) and experimental designs must be conducted to confirm our findings (Mansell et al., 2014). Finally, the discussion of the results was based on studies using different samples and interventions than those used in this study. The interpretation of results should be carefully considered and further investigation including patients with CLBP undergoing physiotherapy should be conducted to confirm our findings.

5. Conclusion

This study aimed to clarify the role of pain and disability changes to patients' perceptions about their improvements after a physiotherapy programme. Changes in these domains were significantly related and contributed to explaining a partial proportion of variance in patients' perception of improvement. However, these findings suggested that pain and disability may not be the only potential benefits of physiotherapy perceived by patients with CLBP. The relevance of assessing other outcome domains was reinforced and should be addressed in future studies.

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5.4. Study 4 - Minimal important change values for pain and disability: Which is the best to identify a meaningful response in patients with chronic low back pain?

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Minimal important change values for pain and disability: Which is the best to identify a meaningful response in patients with chronic low back pain?

Abstract

Purpose: To examine the association between different minimum important change (MIC) values for pain and disability and a successful response in global perception of improvement in patients with chronic low back pain (CLBP) undergoing physiotherapy.

Methods: A prospective cohort study was conducted. At baseline, all participants completed a sociodemographic and clinical questionnaire, the Numeric Pain Rating Scale and the Quebec Back Pain Disability Scale. After a multimodal physiotherapy program, the Global Perceived Effect Scale was completed together with pain and disability measures. The association of the different literature MIC values for pain and disability with a successful response on the Global Perceived Effect Scale was analyzed using logistic regression models. The discrimination power, sensitivity, specificity and predictive values were computed.

Results: A total of 183 patients with CLBP participated in this study. A reduction of 30% in disability (OR= 7.8; AUC= 0.73; Sensitivity=0.71; Specificity=0.75) most accurately identified patients who perceived a global improvement on the Global Perceived Effect Scale. Composite criteria using both pain and disability MIC values presented high odds ratios and specificity values but failed to identify patients who perceived a meaningful improvement.

Conclusion: A 30% reduction in disability is recommended to identify patients with CLBP who achieve a clinical improvement with physiotherapy treatment.

Keywords: Chronic low back pain; Minimum important change values; Pain Intensity; Disability; Responder analyses

Introduction

Chronic low back pain (CLBP) is a common health condition that has a high impact in patients' live and health services (Gouveia et al., 2016). A global research effort has been carried out in the search for effective interventions, but its application to clinical practice is still limited (Hodder et al., 2016). The presentation of results and their generalization, often based on the mean between-group differences and statistical significance, is pointed out as one of the reasons (Armijo-Olivo, 2018). In this regard, there is a growing recognition that clinical research should report not only the statistically significant differences between interventions, but also the clinical relevance of their results (Armijo-Olivo, 2018; Snapinn & Jiang, 2007).

A "responder analysis" is a proposed approach to address this challenge (Armijo-Olivo, 2018; FDA & HHS, 2009; Snapinn & Jiang, 2007). This approach involves the identification of participants who achieved a minimum important change (MIC) in a relevant outcome domain in order to dichotomize the sample into "responders" and "non-responders". This approach is also recommended in regulatory guidance documents. For example, the FDA guidance for industry specifically recognized the responder analysis as a useful complement of an usual analysis based on statistical significance (FDA & HHS, 2009). In the last guidance document, the FDA defined the responder definition as "*the individual patient PRO score change over a predetermined time period that should be interpreted as a treatment benefit*" (FDA & HHS, 2009). However, it is important to clarify that this approach should not replace or prevail over statistical significance analysis. Instead, responder analysis may help to understand whether the effects of an intervention were meaningful for patients, improving the interpretation of the results and facilitating the clinicians' decisions in clinical practice (e.g., supporting the decision to discharge a patient'). Therefore, the role of promoting the transmission of knowledge to clinical practice is an important strength of this approach.

The choice of values representing a MIC is a key aspect in the responder analysis. Distribution-based methods and anchor-based methods are frequently used to determine the MIC values in different types of outcome measures (Wyrwich, Norquist, Lenderking, & Acaster, 2013). Both have strengths and weaknesses (Ostelo et al., 2008) and, perhaps for that reason, other values representing clinical important changes have emerged from international consensus groups (Dworkin et al., 2008;

Ostelo et al., 2008). A challenge described by current literature is the variability of MIC values used in clinical studies. For example, a recent systematic review identified 45 different MIC values corresponding to 10 outcome domains in a total of 195 physiotherapy trials that included patients with CLBP (Pires, Cruz, Gomes, & Nunes, 2020). Despite most of the MIC values used correspond to pain and disability domains (Henschke, Van Enst, Froud, & Wg Ostelo, 2014; Pires et al., 2020), a main concern raised about the wide range of values used that compromises the comparison of results between different studies. In addition, an arbitrary choice of different MIC values or the use of methods that do not reflect the patient's view has been reported in the literature (Henschke et al., 2014)

To address both concerns, it has been argued that a criterion of intervention success should be related to whether the patient perceives the intervention results to be meaningful. Therefore, analyzing which change values are best associated with the patient's global perception of improvement is a recently adopted approach (Kamper et al., 2010; Patel et al., 2018), which is in line with the responder analysis assumptions. Patient's global perception of improvement is an overall outcome domain covering multiple aspects related to intervention's benefits that are relevant to patients (Geisser et al., 2010; Scott & McCracken, 2015). Through a global question, patients are asked about the perceived changes throughout treatment, providing their own perspective on the gains achieved. This outcome domain has been recommended as an independent criterion in order to interpret if changes in specific domains (e.g. disability or pain) were meaningful to patients (Wyrwich et al., 2013).

In summary, the literature describes a large variability of MIC values to analyze clinical importance of intervention results which prevents comparison between studies. In addition, the lack of integration of the patient's view in the identification of MIC values has also been emphasized. The aim of this study was to examine the association of MIC values described in literature with a successful response in patient's global perception of improvement in patients with CLBP undergoing physiotherapy. A secondary aim was to compute sensitivity, specificity and predictive values for each MIC value using patient's global perception of improvement as an independent criterion.

Materials and methods

- Study design and setting

A prospective cohort study was conducted between October 2015 and December 2018. Patients referred for physiotherapy due CLBP were recruited from 20 public and private health services in Portugal. The Ethics Committee of the Local Health Unit approved this study. All participants provided their informed consent prior to participating.

- Participants and intervention

A standardized protocol was followed by trained physicians and physiotherapists in recruitment and examination process. Non-specific low back pain was defined as "*tension, soreness and/or stiffness in the lower back region for which it isn't possible to identify a specific cause of the pain; several structures in the back, including joints, discs and connective tissues, may contribute to symptoms*" (Savigny, Watson, & Underwood, 2009). Low back pain was considered non-specific only when local physicians and physiotherapists were confident that no specific cause was associated with patients' symptoms. Patients were included if they had nonspecific CLBP (lasting at least 12 weeks) with or without referred leg pain; aged between 18 to 65 years; were literate in Portuguese; and had low back pain intensity ≥3 (measured by the Numeric Pain Rating Scale) on the day of the initial evaluation. The exclusion criteria were clinical signs of serious or specific pathologies (fracture, inflammatory disorder, radicular syndrome) (Hartvigsen et al., 2018); pregnancy; back surgery in the last 12 months; or conservative treatment in the last 3 months. Patients who accepted to participate in the study underwent a multimodal physiotherapy program. The physiotherapists who collaborated in the study were responsible for the characteristics of the physiotherapy program. On this point, it is relevant to clarify that the interventions applied were not under analysis. The duration of physiotherapy intervention, the number of participants who did not complete the intervention and their reasons were recorded.

- Instruments

At baseline, all participants completed a sociodemographic and clinical questionnaire, an 11-point Numeric Pain Rating Scale to rate their pain and the Portuguese version of the Quebec Back Pain Disability Scale (0 to 100) to assess their disability (Cruz et al.,

2013). Eight weeks later (or earlier if they were discharged), the Global Perceived Effect Scale (Freitas, Pires, Nunes, & Cruz, 2019) was applied together with the pain and disability measures.

The Global Perceived Effect Scale is a transition scale, ranging from -5 (“vastly worse”) to +5 (“completely recovered”), designed to evaluate global change in health status as perceived by patients. This measure was cross-culturally adapted to the European Portuguese population showing adequate test-retest reliability (ICC= 0.758, 95% CI 0.698–0.855), convergent validity (r=0.677; p=0.001) and responsiveness (Areas under the curve values of 0.71 and 0.83) (Freitas et al., 2019). A score greater than or equal to 3 after the intervention was considered clinically important in patients with CLBP (Freitas et al., 2019). The Numeric Pain Rating Scale is composed of 11 points, ranging from 0 (no pain) to 10 points (worst imaginable pain). It is a very simple to use measure and has shown adequate psychometric properties in patients with chronic pain (Farrar, Portenoy, Berlin, Kinman, & Strom, 2000). The Quebec Back Pain Disability Scale is a functional disability measurement scale that consists of 20 items with 6 response categories each (0- “not difficult at all” to 5- “unable to do”). The total score is determined by a summation of the scores for each individual item ranging from 0 (no disability) to 100 (severe disability). The Portuguese version of this scale has shown good test-retest reliability (ICC= 0.696) and validity ($\rho = 0.62$; $p < 0.001$), excellent internal consistency (Cronbach’s $\alpha = 0.95$), and moderate responsiveness (Area under the curve= 0.741) (Cruz et al., 2015).

- Data analysis

Absolute and percentage changes in pain intensity and disability were computed. The MIC values used in this exploratory analysis were chosen taking into account the most used values in clinical trials with patients with CLBP (Henschke et al., 2014) and the values recommended by international consensus groups (Dworkin et al., 2008; Ostelo et al., 2008). Thus, the patients who achieved 2 points (Ostelo et al., 2008), a 30% (Ostelo et al., 2008) and a 50% improvement in pain (Dworkin et al., 2008; Henschke et al., 2014; Ostelo et al., 2008), and 20 points (Ostelo et al., 2008) and a 30% (Ostelo et al., 2008) improvement in disability were identified in the database. Additionally, two composite criteria, including pain and disability, were analyzed: a 2 point reduction in pain plus a 20 point reduction in disability; and a 30% reduction in pain and disability. To analyze the association of different MIC values (independent variables) with a

successful response on the global perception of improvement (dependent variable - Global Perceived Effect Scale scores ≥ 3) (Freitas et al., 2019), odds ratios (OR) were calculated using logistic regression models. The discrimination power was evaluated through area under ROC curve (AUC). Finally, sensitivity, specificity and predictive values for each MIC value were computed.

Results

Of the 235 participants assessed for eligibility, 52 were excluded for not meeting eligibility criteria or for not accepting to integrate the study (see Figure 1). Sociodemographic and clinical characteristics of the 183 participants (mean age 48.02±10.53 years; 80.3% female) assessed at baseline are present in Table 1. Of those, 173 (94.5%) completed a physiotherapy program and attended a mean of 14.15 (±2.87) physiotherapy sessions. At baseline, the mean (±SD) pain intensity and disability scores were 5.8(±1.8) and 36.5 (±17.7), respectively. Most of the 183 participants were employed (83.1%), reported radiating pain (66.1%) and had pain for more than 24 months (68.3%).

Figure 1: Study flow-chart

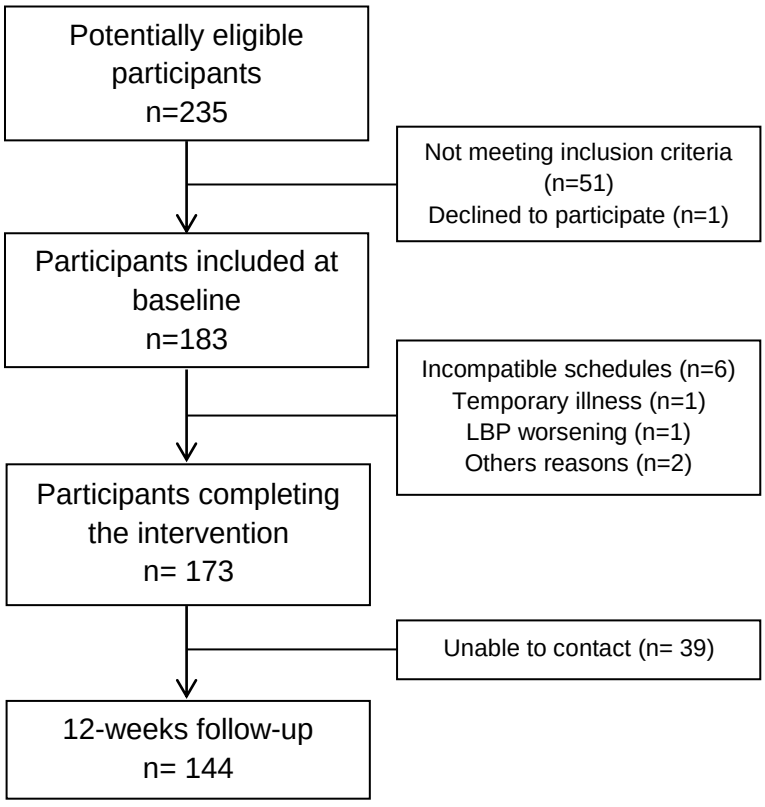

Table 1: Baseline characteristics of the participants

Variables		Total Sample (n=183)
Age*		48.02±10.53
BMI (kg/m^2)*		26.18±4.28
Gender [N (%)]	Male Female	36 (19.7%) 147 (80.3%)
Educational level [n (%)]	Primary/Basic education High school/ College	74 (40.4%) 109 (59.6%)
Working status [n (%)]	Employed Not Active	152 (83.1%) 31 (16.9%)
Duration of pain [n (%)]	3–24 months >24 months	58 (31.7%) 125 (68.3%)
Pain Irradiation [n (%)]	Yes No	121 (66.1%) 61 (33.3%)
Medication [n (%)]	Yes No	85 (46.4%) 98 (53.6%)
Pain Intensity (0-10 NPRS)*		5.86±1.88
Disability (0-100 QBPDS)*		36.54±17.78
* (mean ± SD);		

After the intervention, the mean pain intensity was 3.24±2.29 (ranging from 0 to 10) while the mean disability score was 23.03±16.94 (ranging from 0 to 94). Table 2 presents the percentage of participants who attained the different MIC values according to the successful response on the Global Perceived Effect Scale.

Table 2: Participants who attained the different MIC values according to the response on the Global Perceived Effect Scale

Minimum important change values		GPES score	
		< 3 Points (n=49)	**≥ 3 Points** (n=124)
≥2 Points improvement in pain intensity	No	25 (14.5%)	33 (19.1%)
	Yes	24 (13.8%)	91 (52.6%)
≥30% improvement in pain intensity	No	29 (16.8%)	32 (18.5%)
	Yes	20 (11.6%)	92 (53.2%)
≥50% improvement in pain intensity	No	36 (20.8%)	42 (24.3%)
	Yes	13 (7.5%)	82 (47.4%)
≥20 Points improvement in disability	No	45 (26%)	81 (46.8%)
	Yes	4 (2.3%)	43 (24.6%)
≥30% improvement in disability	No	37 (21.4%)	35 (20.2%)
	Yes	12 (2.9%)	89 (51.4%)
≥2 Points improvement in pain intensity AND ≥20 Points improvement in disability	No	47 (27.2%)	88 (50.9%)
	Yes	2 (1.2%)	36 (20.8%)
≥2 Points improvement in pain intensity AND ≥20 Points improvement in disability	No	42 (24.3%)	50 (28.9%)
	Yes	7 (4%)	74 (42.8%)

Table 3: Associations of the different MIC values for pain and disability with a successful response on the Global Perceived Effect Scale

Minimum important change values		Odd Ratio (95% CI)	AUC
≥2 Points improvement in pain intensity	No Yes	1 2.8 (1.4-5.7)	0.62
≥30% improvement in pain intensity	No Yes	1 4.16 (2.0-8.3)	0.66
≥50% improvement in pain intensity	No Yes	1 5.4 (2.6-11.3)	0.70
≥20 Points improvement in disability	No Yes	1 5.9 (2.0-17.7)	0.63
≥30% improvement in disability	No Yes	1 7.8 (3.6-16.7)	0.73
≥2 Points improvement in pain intensity AND ≥20 Points improvement in disability	No Yes	1 9.6 (2.2-41.7)	0.62
≥30% improvement in pain intensity AND disability	No Yes	1 8.9 (3.7-21.3)	0.73
AUC: Area under ROC curve			

Table 3 summarizes the associations of the different MIC values with Global Perceived Effect Scale scores ≥3 together with the discriminative power. The sensitivity, specificity and predictive values of each MIC value are presented in Table 4.

Table 4: Sensitivity, specificity, and predictive values of pain and disability MIC values in relation to a successful response on the Global Perceived Effect Scale

Minimum important change values	Sensitivity (95% CI)	Specificity (95% CI)	+PV	-PV
≥2 Points improvement in pain intensity	0.73 (0.64-0.80)	0.51 (0.37-0.64)	0.79	0.43
≥30% improvement in pain intensity	0.74 (0.65-0.81)	0.59 (0.45-0.71)	0.82	0.48
≥50% improvement in pain intensity	0.66 (0.57-0.73)	0.73 (0.59-0.83)	0.86	0.46
≥20 Points improvement in disability	0.35 (0.26-0.43)	0.92 (0.80-0.96)	0.91	0.36
≥30% improvement in disability	0.72 (0.63-0.78)	0.76 (0.61-0.85)	0.88	0.51
≥2 Points improvement in pain intensity AND ≥20 Points improvement in disability	0.29 (0.21-0.37)	0.96 (0.86-0.98)	0.95	0.35
≥30% improvement in pain intensity AND disability	0.60 (0.50-0.67)	0.86 (0.73-0.92)	0.91	0.46
+PV – Positive predictive value; -PV – Negative predictive value				

Discussion

This study provides preliminary evidence on the MIC values for pain and disability that can best relate to the perceived global improvement of patients with CLBP after physiotherapy treatment. A reduction of 30% in disability and 30% in pain plus 30% in disability showed higher associations together with higher AUC values. The composite criteria showed high OR, specificity, and positive predictive values. However, the sensibility and negative predictive values were poor. Considering the whole analysis, a reduction of 30% in disability was the MIC value with better performance and its use in research and clinical practice can be recommended.

Overall, the ability of the MIC values to discriminate patients with CLBP who perceived or not perceived a global improvement was modest. In particular, all pain values (i.e., those most used in clinical research) showed poor discriminative power (AUC≤0.70) and moderate values of sensitivity. These data seems to support that pain improvement alone is not a reliable indicator of the success of the intervention if the overall assessment of the patient is considered. The relevance of other domains beyond pain, when patients consider their global improvement, may explain these findings and has been discussed in previous studies (Evans, Bronfort, Maiers, Schulz, & Hartvigsen, 2014; Hush et al., 2009). This perspective may also explain the greater association and discriminative capacity found for the disability values used in this study. The fact that disability is a more comprehensive construct representing the perceived impact of pain on the patient's daily activities may explain the best relation between disability MIC values and global perception of improvement.

Contrary to expected, the use of criteria including MIC values of both pain and disability cannot be clearly recommended. Despite the higher ORs, specificity, and positive predictive values, the composite criteria showed poor sensitivity and negative predictive values, suggesting that many patients who perceived a global improvement did not achieve these criteria (Table 2). This problem was also observed for other analyzed MIC values. Analyzing less ambitious MIC values could be a logical next step (e.g., reduction of 20% in pain), but they could probably not distinguish between a natural improvement of the condition and an improvement associated with the treatment. Therefore, the use of MIC values from other health domains or multidimensional measures may be more plausible and should be considered in future studies.

In this study, the impact of sample characteristics on results should not be underestimated. Most participants reported pain radiating to the lower limb and had lower back pain for more than 24 months. Interestingly, mean levels of disability at baseline were low (< 40 points out of 100). For example, Meisingset, Stensdotter, Woodhouse, and Vasseljen (2018) found that pain duration and disability scores at baseline were strong predictors for the global perception of improvement in patients with chronic neck pain undergoing physiotherapy (Meisingset, Stensdotter, Woodhouse, & Vasseljen, 2018). Other recent study developed by Bicket, Pasquina, and Cohen (2017) indicated that leg pain had a great predictive ability to identify clinically important improvements (global perceived effect) in patients with lumbar radiculopathy after medical interventions (Bicket, Pasquina, & Cohen, 2017). The interaction of these and other factors with the association between the various MIC values and the global perception of improvement was not considered in our study. Therefore, this issue should be addressed in future studies in order to define the most appropriate MIC values for different subgroups of patients with CLBP.

Others studies analyzing the clinical validity of several MIC values used in a physiotherapy context with patients with CLBP are unknown. Therefore, the improvement of the standardized use of MIC values in both clinical practice and physiotherapy research can be an important implication of this study. However, there are some limitations to consider. A high variability of measures used to assess pain and disability in patients with CLBP has been reported in the literature (Chapman et al., 2011). Because this study analyzed MIC values from only one measure for each domain, this fact may limit the transferability of our results. Finally, the data was collected from patients with CLBP who underwent physiotherapy treatment; thus, it is unknown if the results can be generalized to other low back pain samples and interventions.

In conclusion, a 30% reduction in disability is recommended to identify patients with CLBP who achieve a clinical improvement with physiotherapy treatment. The use of this MIC value to conduct a responder analysis in clinical research may improve the comparability of future studies and the transmission of knowledge to clinical practice. In addition, this MIC value can be used by physiotherapists in clinical practice in order to support their decision when discharging a patient with CLBP. This study should be the starting point for future studies to identify MIC values that can most accurately classify patients with CLBP who perceive a meaningful improvement after physiotherapy treatment.

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5.5. Study 5 - Beyond pain and disability: an explanatory mixed methods study exploring outcomes after physiotherapy intervention in patients with chronic low back pain

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Beyond pain and disability: an explanatory mixed methods study exploring outcomes after physiotherapy intervention in patients with chronic low back pain.

Abstract

Purpose: The primary aim of this study was to explore relevant outcome domains for patients with chronic low back pain (CLBP) undergoing physiotherapy. A secondary aim was to examine the agreement between meaningful changes in pain and disability and the global perception of improvement.

Methods: An explanatory mixed methods design was employed. Twenty-two patients with CLBP completed self-reported measures before and after a physiotherapy programme. After the intervention, three focus groups were conducted with patients who perceived an overall improvement. Discussions were recorded, transcribed and analysed using thematic analysis.

Results: Quantitative analysis showed an inconsistent relationship between changes in pain and disability measures and global improvements as perceived by patients. Two main themes emerged from the thematic analysis: “pain relief” (subthemes: reducing pain intensity and other symptoms; reducing medication intake; improving sleep quality) and “gaining control over the LBP condition” (subthemes: ability to self-manage; return to function; and sense of well-being and normality).

Conclusion: Patients with CLBP perceived multiples outcomes from physiotherapy treatment that cover the domains of global, physical, mental and social health. These study findings suggest that the targets of measurement for physiotherapy need to be expanded in order to reflect outcome domains valued by patients.

Key Words: Patient-relevant outcomes; Outcomes assessment; Chronic low back pain; Physiotherapy

Introduction

Chronic low back pain (CLBP) is a highly prevalent condition, with a large and rising impact in developed societies [1–3]. The aetiology of CLBP remains unclear, but the contribution of multiples factors including biological, psychological or social factors, to disabling low back pain (LBP) is widely recognised [4]. Moreover, the impact of CLBP on multiple health-related domains has been documented in the literature [5,6]. For this reason, the choice of best treatment and study of this condition is a challenge for clinicians and researchers worldwide.

Ensuring proper outcome assessment is critical in order to compare and quantify the effects associated with the applied interventions, as well as to promote well-informed healthcare choices [7,8]. Physiotherapy is recommended as a first-line intervention for patients of CLBP [9,10] and its effectiveness has been usually measured through changes in pain and disability. A recent systematic review, which included 195 physiotherapy trials of patients with CLBP, found that these two domains were used in 85% and 86% of studies respectively [11]. Studies appraising physiotherapy clinical practice have showed an identical trend [12]. These findings support an important consensus within the fields of physiotherapy and research in priority outcome domains, but their alignment with patient-relevant outcome domains has been recently questioned [13–15].

To address this issue, patients' perception of improvement measures have been used to understand patients' views on treatment outcomes and its relation to outcomes usually measured. At this point, pain and disability do not appear to be reliable indicators of the intervention's success, as perceived by patients [16,17] and they have emerged among other equally patient-relevant outcomes [17–20]. For example, previous studies have reported that patients with nonspecific chronic pain take into account other treatment outcomes such as self-efficacy or sleep function when determining their global perception of improvement [20,21]. Likewise, a recent pilot study reported that pain and disability changes explained no more than 36% of the variance in global perception of improvement in patients with CLBP undergoing physiotherapy, indicating that other outcome domains which are not usually measured need to be considered [22]. In fact, if an outcome conceptual framework such as that proposed by PROMIS® is considered, pain and disability domains fit only in the core area of physical health [23,24]. Other core areas of outcomes such as mental health and social health do not seem to be usually measured [11].

Overall, these findings suggest not only the potential inconsistency between patients' and researchers' views, but also an under representation of patient-relevant domains in the way treatment outcomes have been measured. Studies exploring this discrepancy are scarce and some issues need to be explored, particularly in the context of physiotherapy and CLBP. Firstly, the agreement between meaningful changes in pain and disability and clinical improvement as perceived by patients needs to be addressed. Secondly, there is a lack of knowledge about other outcome domains that are meaningful to patients with CLBP undergoing physiotherapy. A better understanding of patients' meaningful outcomes may provide additional information to explain the potential disagreement between outcomes usually measured and the patient's perception of improvement. This study aimed to address both issues by (1) analysing the alignment between pain and disability scores and the global perception of improvement; and (2) exploring other relevant outcome domains for patients with CLBP undergoing physiotherapy.

Material and Methods

- Study design

An explanatory mixed methods design [25] was used, involving patient-reported outcome measures and focus group discussions. The study started with a before-and-after physiotherapy treatment design (quantitative phase) followed by focus group discussions (qualitative phase). Considering the purpose of this study, emphasis was given to the qualitative phase. This study protocol was approved by the ethical committee of the local health unit and written informed consent was obtained from all participants prior to data collection.

- Participants and recruitment

Study recruitment was conducted from January 2019 to May 2019. Ensuring sample heterogeneity was a priority in the recruitment process due to the potential influence of participants' specific characteristics on outcomes they perceived as meaningful. At this point, the place of recruitment was considered a key aspect to include participants with different clinical and socioeconomic characteristics, and at different stages of the condition. Thus, a convenience sample of patients with CLBP were recruited from a chronic pain medical department of a public hospital, a physiotherapy outpatient clinic

(private practice) and two primary care centres in a specific region of Portugal. All potential participants were screened for eligibility by trained local health professionals. Patients with active LBP for at least 12 weeks [26], with or without leg pain, aged between 18 and 65 years and literate in European Portuguese were included. Exclusion criteria were: specific cause for LBP such as fracture, infection, inflammatory disorder, tumour, osteoporosis, radicular pain [27]; history of conservative treatment or back surgery in the prior 3 and 12 months, respectively; and pregnant or puerperal women. The recruitment process ended when a minimum of 15 participants met the criteria for integrating the qualitative phase (see criteria below).

- Intervention

All participants who agreed to participate in the study and met the eligibility criteria received a multimodal physiotherapy programme. The intervention was the responsibility of five physiotherapists who collaborated in this study. The duration, characteristics and goals of the intervention were recorded but were not under analysis.

- Data collection

Quantitative phase

All participants were assessed immediately before and eight weeks after the beginning of physiotherapy treatment (or earlier if they were discharged). At baseline, a clinical and sociodemographic questionnaire was completed by participants (see Table 1) along with functional disability and pain intensity self-report measures. After the intervention, the Global Perceived Effect Scale (GPES) was applied together with pain and disability self-report measures. The Quebec Back Pain Disability Scale (QBPDS) is a 20-item self-report measure, used to assess functional disability in patients with LBP. The total score ranges from 0 to 100, with higher scores indicating higher levels of functional disability. Its psychometric properties were tested on Portuguese patients with CLBP, showing adequate internal consistency, construct validity, test-retest reliability and responsiveness [28,29]. A reduction of at least 30% on the QBPDS after an intervention has been identified as a minimum important change (MIC) [30]. The Numeric Pain Rating Scale (NPRS) is a single-item scale used to assess pain intensity, ranging from 0 (no pain) to 10 (worst possible pain). The NPRS is widely used in patients with chronic pain, showing acceptable psychometric properties [31]. A

reduction of 2 or more points has been considered indicative of the MIC [30]. Global perception of improvement was assessed through the GPES. The GPES is an 11-point transition scale ranging from -5 (“vastly worse”) to +5 (“completely recovered”). The GPES showed adequate test-retest reliability, validity and responsiveness in patients with CLBP [32]. A score change of 3 or more points was found as the MIC [32].

Qualitative phase

Participants who completed the intervention and perceived a global meaningful improvement (score of ≥3 in the GPES) were invited to participate in the qualitative phase. Participants who did not perceive an overall gain from the intervention were excluded to avoid misperception between expectations before the intervention and perceived outcomes after the intervention [33].

Qualitative data were collected through focus group discussions that occurred within 2 weeks of each participant's last treatment session. This time interval was chosen to ensure an appropriate number of participants for each focus group (between 5 to 7), while at the same time avoiding participants' recall bias concerning the perceived outcomes after treatment. Focus groups were chosen because they promote debate and clarify divergent and convergent perspectives among participants, providing a range of views and data that cannot be attained through individual interviews [34].

The first author (DP) was involved in the recruitment phase, therefore all focus groups were conducted by second author (EC). A third author (DC) took notes during interviews, covering the main ideas and themes addressed by participants. EC is a senior researcher (PhD in Physiotherapy) with wide experience in facilitating focus group discussions and qualitative methods. DC is a physiotherapist who received postgraduate training in qualitative methods before starting the study. Both had no previous contact with the participants.

A semi-structured interview schedule was developed in advance and tested in four pilot interviews. After minor modifications, the final version included open-ended and probe questions and was used to guide focus group discussions (see Table 1). Prior to discussions, the researchers introduced themselves and a brief explanation about study aims and focus group rules was given. Participants were then invited to choose a pseudonym to use during the discussion. Each discussion started with the presentation of the GPES which was used to contextualise and introduce the first open-ended question. At the final phase of each focus group discussion, the moderator briefly

summarised the main themes discussed, and additional time was given for any comments or new ideas not previously discussed [35].

Table 1: Semi-structured interview schedule

Questions	Probe questions
After physiotherapy, all of you completed a short questionnaire to assess the extent to which you have improved with physiotherapy.	You just mentioned that… Can you explain better?
• When you say you got better, what are you thinking about? In what aspects have you felt improvements?	Can you describe…. in greater detail?
• Compared to the beginning of physiotherapy treatment, what are the differences in the current state of your back?	Can you give me an example of this?
• Given your experience, what benefits can a person with chronic low back pain get from physiotherapy?	Did you talk about… why do you consider it important?

The focus groups were conducted at the physiotherapy outpatient clinic in a private, nonclinical room prepared for that purpose and lasted between 45 and 70 minutes. Discussions were both audio and video recorded to facilitate differentiation between similar voices and to obtain an additional source of information.

- Data analysis

Quantitative data

Descriptive statistics were used to summarise clinical and sociodemographic characteristics as well as patient-reported outcome measures scores at baseline and post-intervention. An individual analysis [36] was conducted considering the number of participants who attained the MIC in pain intensity (≥2 points), functional disability (≥30%) and global perception of improvement (≥3 points).

Qualitative data

Focus group discussions were transcribed verbatim and anonymised by the first author (DP). Transcriptions were then audit by the third author acting as co-moderator (DC). Inductive thematic analysis was used to analyze the data and identified the emergent themes, following the six phases described by Braun and Clarke (2006)[37]. The first author (DP) primarily performed full data set analysis. DP is a PhD student, a musculoskeletal physiotherapist with 8 years of experience and holds an interest in outcome research in patients with chronic pain. DP had postgraduate training in

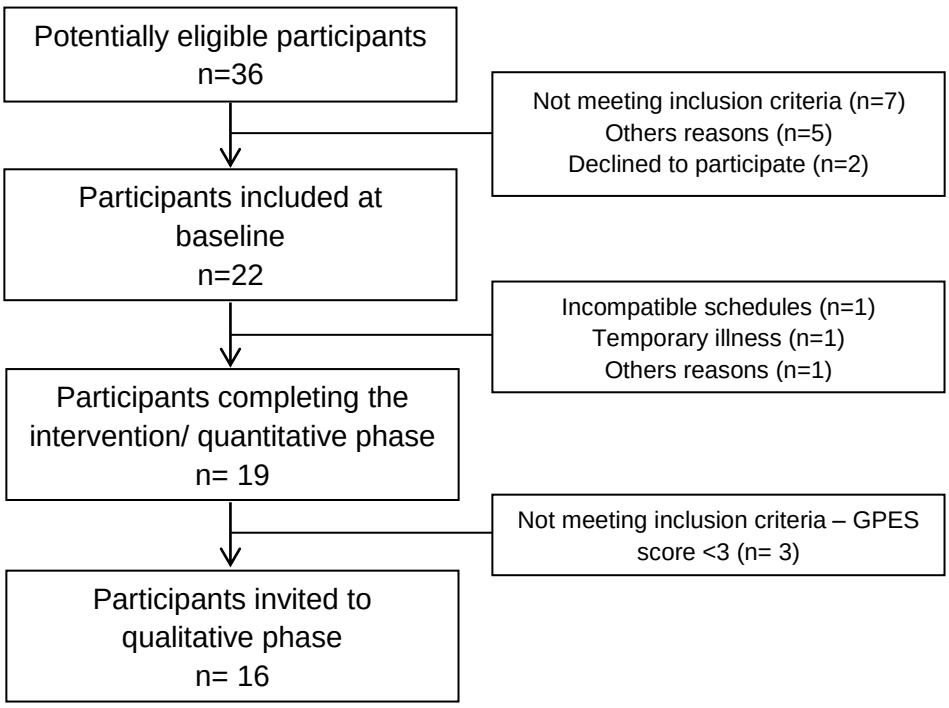
qualitative methods and previous experience using thematic analysis. All phases of data analysis were supervised and findings were reviewed by EC. Finally, codes and themes or subthemes generated were revised and discussed within the research team until a consensus was reached. A summary of findings including illustrative quotes, were sent to participants who then had the opportunity to give their feedback on findings.

Results

- Sample and characteristics of participants

A total of 22 participants met the eligibility criteria, of which 19 completed the physiotherapy intervention (Figure 1). The majority of participants were female (n=18), had higher education (n=16), were employed (n=14) and had leg referred pain (n=16). Age (range 22–65 years), pain intensity (range 4–9 points) and disability levels (range 13–81 points) were heterogeneous among participants at baseline. Demographic and clinical characteristics of participants are detailed in Table 2.

Figure 1: Data Collection Flowchart



- Quantitative analysis: Patient-reported outcome measures

Immediately after the physiotherapy intervention, 15 and 10 participants had attained a MIC in pain intensity (a reduction ≥2 points) and disability (a reduction ≥30%), respectively. Sixteen of 19 participants attained the MIC in global perception of change (≥3 points). For six participants, a global improvement as perceived by patients was not a reliable indicator of MIC in pain and disability (Table 2). Because three participants did not attain the MIC in global perception of improvement, only 16 participants took part in 3 focus group discussions (Figure 1).

- Qualitative analysis: Themes and subthemes

Two core themes emerged from the thematic analysis concerning the outcomes perceived by participants after physiotherapy treatment: pain relief; and gaining control over the LBP condition. These themes embraced other perceived gains (subthemes) such as reducing pain intensity and other symptoms, reducing medication intake, improving sleep quality, returning to function, ability to self-manage and achievement of a sense of well-being and normality. Themes and subthemes are described and contextualised below using representative quotations.

Main theme 1: Pain relief

Participants considered pain relief a major outcome of physiotherapy treatment. By reducing their pain, physiotherapy treatment helped them to make other important gains, such as reducing medication intake and improving sleep quality. Therefore, pain relief emerged as a major theme that embraces three sub-themes representing other patient-perceived outcomes.

*Subtheme 1.1: Reducing pain intensity and other sy*mptoms

According to participants, physiotherapy treatment reduced their pain intensity, but it did not eliminate it. Nevertheless, these changes appear to have been quite significant for participants. They emphasised they felt lower pain intensity levels at night, at waking up or during daily activities. Despite the importance assigned to reducing pain, participants reported the relief or elimination of other physical symptoms. They felt their muscles were less tense and their backs less stiff after the treatment which gave them greater mobility when waking up and while working.

Table 2: Characteristics of the sample and results of patient-reported outcome measures

Sociodemographic characteristics						Clinical characteristics									
									Pain intensity		Disability		Minimum important change		
Patient	Age	Gender	Education	Working Status	Clinical setting	Intervention	Pain Duration	Irradiated pain	Baseline	Post-treatment	Baseline	Post-treatment	Pain intensity	Disability	Global perception of change
1	65	F	Primary/Basic	Employed	Outpatient clinic	AP; Group	>24 months	No	4	3	54	43	x	x	√
2	41	F	High school/College	Employed	Primary Care	LP; Individual	>24 months	Yes	5	3	31	19	√	√	√
3	22	F	High school/College	Employed	Outpatient clinic	AP; Group	>24 months	Yes	6	-	41	-	-	-	-
4	50	F	High school/College	Employed	Hospital Pain unit	AP; Group	>24 months	Yes	6	4	34	67	√	x	√
5	37	F	High school/College	Employed	Outpatient clinic	AP; Group	>24 months	Yes	5	3	43	24	√	√	√
6	48	F	Primary/Basic	Employed	Outpatient clinic	AP; Group	>24 months	Yes	8	5	47	60	√	x	x
7	55	M	High school/College	Not active	Hospital Pain unit	LP; Individual	>24 months	Yes	7	4	64	53	√	x	x
8	56	F	Primary/Basic	Not active	Outpatient clinic	AP + LP; Individual	>24 months	Yes	8	0	72	38	√	√	√
9	58	F	Primary/Basic	Employed	Hospital Pain unit	LP; Individual	3–24 months	Yes	8	3	81	67	√	x	√
10	59	F	High school/College	Not active	Hospital Pain unit	LP; Individual	>24 months	Yes	7	1	80	18	√	√	√
11	64	M	High school/College	Not active	Outpatient clinic	LP; Individual	>24 months	No	7	3	28	15	√	√	√
12	54	F	Primary/Basic	Not active	Outpatient clinic	AP; Group	>24 months	Yes	9	6	63	36	√	√	√
13	44	F	High school/College	Employed	Outpatient clinic	LP; Individual	>24 months	Yes	8	2	64	28	√	√	√
14	47	F	High school/College	Not active	Hospital Pain unit	AP + LP; Individual	>24 months	Yes	5	2	44	51	√	x	√
15	32	F	High school/College	Employed	Primary Care	AP; Group	>24 months	No	4	2	35	19	√	√	√
16	29	F	High school/College	Employed	Primary Care	LP; Individual	3–24 months	No	4	1	13	4	√	√	√
17	61	F	High school/College	Not active	Primary Care	LP; Individual	>24 months	Yes	7	-	44	-	-	-	-
18	54	F	High school/College	Employed	Outpatient clinic	AP; Group	3–24 months	Yes	5	-	43	-	-	-	-
19	56	M	High school/College	Employed	Outpatient clinic	LP; Individual	>24 months	No	6	3	31	9	√	√	√
20	39	F	Primary/Basic	Employed	Outpatient clinic	AP; Group	3–24 months	Yes	6	6	20	26	x	x	√
21	63	M	High school/College	Not active	Outpatient clinic	AP + LP; Individual	>24 months	Yes	3	6	20	23	x	x	x
22	43	F	High school/College	Employed	Primary Care	LP; Individual	3–24 months	No	3	3	23	27	x	x	√

Legend: AP – Aquatic Physiotherapy; LP – Land Physiotherapy; M – Male; F- Female; x – Not Attained; √ - Attained

> “Maybe, when I came here I was in 5 of pain, but... and when I left, I was in 3 of pain. So, it’s much better, isn't it?”[Patient 4; FG1]

> “It is not that pain has gone, it does not go, but I already do things, I no longer have to sit down to relieve those strong pains I always have, and doing things, I do them in pain, but not in those painful aches that I had to sit down because I couldn't go on.” [Patient 12; FG2]

> “And the issue of relaxation, the body being much more relaxed and much more appeased, not so tense.” [Patient 22; FG3]

Subtheme 1.2: Reducing medication intake

One outcome of the physiotherapy treatment often reported by participants was the reduction in medication intake. Prior to treatment, medication to reduce pain was a recurring but an unsatisfactory option due to its adverse effects and short-term efficacy. By feeling less pain and learning other pain control strategies, the participants were able to progressively reduce their dependence on medication throughout the treatment. In addition, they felt a lesser need to take medication to help them to sleep and relax.

> “But this helped me a lot, at least to drop the medication that I had been trying to wean for years.” [Patient 5; FG1]

> “I have pain, I have it but I can handle it by taking a weekly anti-inflammatory instead of taking an anti-inflammatory and a daily muscle relaxant as I was doing.” [Patient 2; FG1]

> “It was terrible; I was always completely drugged with so many medicines.” [Patient 10; FG2]

Subtheme 1.3: Improving sleep quality

Another perceived outcome reported by participants was an improvement in sleep quality. Before treatment, they often felt frustrated about the poor quality of their sleep which negatively influenced their daily well-being. From the participants’ point of view, feeling pain during sleeping hours was the main reason for poor quality sleep. The use of medication to improve sleep was therefore frequently reported. Physiotherapy treatment helped them not only to fall asleep more easily, but also to sleep for more hours. They seemed to value sleep quality as a driver for good health. This may explain why they considered the improvement in their sleeping quality as being a meaningful outcome of the physiotherapy treatment.

"The lack of sleep is something that harms everyone, of course, but it moved me a lot…so I had to take one and two pills to get to sleep, to really force the system to sleep, and sometimes even that was not enough. With the sessions, I stopped taking the drug and started to sleep better, and at the same time I started to feel much better during the day." [Patient 5; FG1]

"I didn't know what it was like to sleep, now it's much better, I didn't know what it was like to sleep all night...it had to be movements like this because I couldn't. They were really horrible pains." [Patient 13; FG2]

"After that I started to sleep better, not needing to take anything to get me to sleep, I really started to sleep better and to wake up with better, with more mobility." [Patient 9; FG3]

Main theme 2: Gaining control over the LBP condition

This theme refers to the gains participants had by getting to know and understand their LBP and learning new skills to deal with it. Participants recognised that their current ability to cope with LBP was a direct outcome of the treatment, which helped them to increase activity levels and achieve a sense of returning to normality. This perception of control occurred at the same time as the pain reduction. Both allowed participants to adopt new behaviours and strategies that were acquired in the context of physiotherapy treatment.

Subtheme 2.1: Ability to self-manage

Physiotherapy treatment gave participants the knowledge and tools not only to cope with their symptoms, but also to change their maladaptive beliefs. Due to previous diagnosis or the long duration of LBP, they believed in the irreversible nature of their condition. Therefore, they felt apprehensive, adopting passive strategies such as rest and medication to deal with LBP. Exercise was seen as a harmful and avoidable strategy. Physiotherapy helped them to re-conceptualise their view of LBP giving them a new perspective on the nature and prognosis of their condition. This new understanding helped them to challenge preconceived beliefs and made them less concerned and more aware of their role in improving the condition. Simultaneously, participants learnt active strategies to take control of LBP, thus becoming more confident and proactive in managing daily challenges.

"My physical condition is not limiting and I can do more now than I could before. I avoided certain situations for fear of getting worse. And I learned that it's not quite like that." [Patient 2; FG1]

"We come to the conclusion that we can do things. And when we're feeling bad, we think that we can't do it anymore and that it is worth nothing." [Patient 8; FG3]

"I came to realise that it is important. Rather than doing an activity from beginning to end, it is preferable to divide it into segments. And what this allows me; it allows me to recover, that is, to be well afterwards." [Patient 19; FG1]

Subtheme 2.2: Returning to function

For participants, the ability to perform meaningful activities by themselves was another relevant outcome. Gaining control over their LBP condition was essential to achieving acceptable levels of physical ability and confidence, allowing them to perform daily activities and functional tasks they previously failed to achieve. Participants emphasised that "pain is there but now we can do it", showing not only less pain interference, but also a change in the meaning attributed to pain. Prior to physiotherapy treatment, pain was viewed as a sign of danger that prevented them from performing their daily activities and exercise. Treatment allowed participants to redefine their own perception of activity limitation and progressively regain their independence in meaningful functional tasks and leisure activities.

"Not nowadays, nowadays even making the bed, which was something hard for me to do, I can make the bed well, I can clean the house without medication, I take some walks, (…) I can already do a number of things at home that I couldn't do." [Patient 12; FG2]

"Picking up the laundry, taking the laundry out of the washing machine. I had to have a bench to sit down to pull the laundry from the machine, then either I waited for my daughter or my husband to arrive to take the laundry up, but now I can do it, with difficulty, but I can do it. And I wasn't able to do it." [Patient 8; FG3]

"In terms of locomotion, I stopped using any support. I was unable to climb a single step, and now I can do it. Another situation, for example, was to reach the highest shelves, which I can also do now. Holding my grandson, that was wonderful." [Patient 10; FG3]

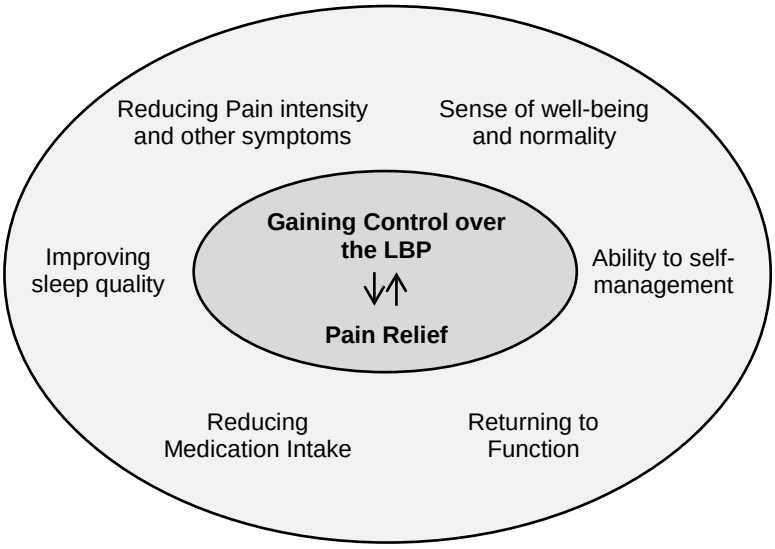
Subtheme 2.3: Sense of well-being and normality

For participants, performing small but meaningful tasks and having the feeling of returning to daily routines with positive emotions, contributed to an overall sense of well-being and normality. They repeatedly used expressions such as "getting back to work well", "feeling good throughout the day", "walking normally" or “my son plays with me” to summarise outcomes of the physiotherapy treatment. The previous impact of LBP on various domains of the participants' lives and health, such as work capacity or emotional well-being, may help to explain the value they gave to this sense of normality.

> “I am returning [to work] and I am returning well, which is very important to me. My biggest concern in having been away so long was to be able to get back to the point of being well at my job. Feeling good, knowing that I could be seated without having any problems.” [Patient 15; FG2]
>
> “It means, therefore, that we face life in another way, more positively, in a more positive way, and not in a negative one. That’s what it looks like. And this transformation is such that the person starts, our self-esteem rises.” [Patient 10; FG3]
>
> “When I do my 8 km daily walks and everything is fine, I do it, I do it already with one hand behind my back.” [Patient 4; FG1]

Themes, subthemes, and their interrelationship are illustrated in a thematic map (Figure 2).

Figure 2: Illustration of the themes and subthemes



Discussion

This mixed methods study provides insight into the perspective of patients with CLBP regarding the outcomes achieved from physiotherapy treatment. The findings of the quantitative phase showed that disability and pain intensity changes were not clearly aligned with patients' global perception of improvement after the intervention. Accordingly, the qualitative data analysis of our study indicated that participants valued another set of outcomes after physiotherapy. Two core themes (pain relief and gaining control over the LBP condition) and six subthemes (reducing pain intensity and other symptoms; reducing medication intake; improving sleep quality; ability to self-manage; returning to function; and sense of well-being and normality) emerged from the data.

The quantitative findings of this study showed that the relationship between disability and pain improvements (represented by MIC) and global perception of improvement were inconsistent. For instance, 7 participants maintained or worsened their levels of pain and disability after physiotherapy but 5 of them achieved the MIC in global perception of improvement. These data may seem unexpected but they are in line with the results of previous studies. The partial contribution of pain and disability changes to patients' perceptions of improvement has been consistently reported in studies using quantitative approaches [21,22,38]. Likewise, qualitative studies have described other outcomes of interventions which play a central role in patients' appraisals about their perception of improvement [17,19,20]. Therefore, if patients value multiple outcome domains, an inconsistent relationship between only two of them and the global perception of improvement is expected.

This rationale was supported by the findings found in the qualitative phase of this study. Other patient-perceived outcomes beyond pain and disability emerged, which reinforce a growing consensus that treatment outcomes have been partially measured. This hypothesis is also supported if an outcome conceptual framework is considered. The themes and subthemes found in this study seem to fit with PROMIS® framework, covering domains of global, physical, mental and social health [23,24]. The PROMIS® domain of physical health is clearly represented by the themes "pain relief" and the subthemes "return to function", "pain intensity and other symptoms" and "improved sleep quality". The theme "gaining control over the LBP condition" fits into the mental health domain of the PROMIS® framework by incorporating aspects such as "ability to self-manage", "self-efficacy", "cognitive barriers" or "apprehension due to condition impact". Finally, the global and social health domains are captured by the subtheme

“sense of well-being and normality”. Taken together, our findings suggest that the traditional assessment targets for physiotherapy’s treatment in patients with CLBP need to be reconsidered and probably expanded.

The relevance attributed by patients to pain relief was not surprising. Pain intensity has often been measured in physiotherapy effectiveness research [11] and has emerged as a core outcome domain in a recent consensus study [39]. Reduced medication intake and improved sleep quality were also highlighted among participants, but assessment of these outcomes in physiotherapy appears to be rare and not standardised [11]. While pain medication has been considered a pain intensity sub-domain [40], sleep quality appears to be a primary domain for patients with chronic pain [18] but less important for researchers [39,41]. Recent evidence has shown that pain elimination is not a realistic goal for patients with chronic pain [20]. This mean that patient appraisal of the success of an intervention tends to integrate other domains such as medication intake or sleep quality, which represent greater meaning to them. In addition, patients in this study expressed concerns about continued use of pain medication while reporting that they value sleep as a requirement for good health. Therefore, the value attributed to these domains may also be related to patients' previous beliefs and priorities.

CLBP is a long-term condition characterised by multiple episodes of recurrence [42] where the patient's ability to autonomously manage fluctuations in LBP becomes particularly important. The second main theme “gain control over the LBP condition” seems to be aligning with this view, but it has been less discussed as an outcome domain in the CLBP literature. Instead, similar themes have been described in recent studies exploring CLBP patients' goals before physiotherapy [43,44]. According to a recent systematic review, patients with LBP expect information from health professionals about the nature of the condition, coping skills and self-treatment strategies [45]. Since physiotherapy might be a way to meet these expectations, it seems plausible that gaining control over LBP emerges as an important physiotherapy outcome for patients. Furthermore, this theme should be discussed in the context of mental and social health. Some negative cognitions such as kinesiophobia or concerns about the nature and prognosis of the condition could be redefined, making patients more confident in their improvement and less anxious. Taking control of their condition allowed patients in this study to resume their social roles, by returning to work, caring for their children or performing leisure activities.

Finally, “return to function” and “sense of well-being and normality” were also valued outcomes by patients. These domains fit into the constructs of disability and health-

related quality of life, respectively, being equally valued by physiotherapists and researchers [39]. As discussed above, these subthemes also seem to integrate aspects related to emotional well-being and social health, indicating the potential impact of physiotherapy on multiple health domains. At this point, the main contribution of this study is that patients seem to relate self-control over the condition to their increased ability to perform functional activities and achieve acceptable levels of quality of life and well-being. Understanding how the sense of control over CLBP can mediate and influence gains in other outcomes should be addressed in future studies.

In summary, the results of this study suggest a potential underrepresentation of patient-centred domains in the outcome measurement process in patients with CLBP undergoing physiotherapy. While researchers and physiotherapists used pain and disability measures to determine whether physiotherapy is effective [11], patients value a broader number of outcomes. The main danger of this gap between researchers and patients is that measurement models that incompletely cover the potential outcomes of an intervention may become widely used despite their lack of validity [46]. An incomplete and invalid assessment of physiotherapy effectiveness distorts our understanding of patient outcomes, affecting the care provided and funded. It is important to clarify that our findings offer no evidence on the hierarchy of the various outcome domains identified. However, they may provide supporting data for the development of new patient-reported outcome measures or a future core outcome set for physiotherapy intervention in patients with CLBP.

Studies exploring the perspective of patients with CLBP on potential outcomes of physiotherapy are scarce. This study provides new insight into this topic and their findings may promote the integration of patient perspective into the way physiotherapy outcomes are measured. Along with the diversity of recruitment settings, these were the main strengths of this study. However, the results of this study need to be interpreted in light of some limitations. This study was not conducted to provide cause-effect relationships. The set of outcomes described come from the patients' perception and so they probably include outcomes that cannot be attributed to physiotherapy treatment [47]. Therefore, this issue should be addressed in future studies using adequate methods. Another limitation is related to the data collection methods used. Focus groups facilitate interaction between participants, but some participants may have more difficulty expressing their point of view than those with greater communication skills. The fact that discussion facilitators were aware of this issue diminished this concern.

Conclusion

This study provides additional data to understand the discrepancy between the outcome domains valued by researchers and patients with CLBP undergoing physiotherapy. Minimum important changes in pain and disability showed an inconsistent relationship with global perception of improvement. In turn, patients highlighted gains in multiple health domains that ranged beyond pain and disability reduction. Outcome domains rarely used in the CLBP and physiotherapy research such as medication intake, sleep quality, gain control over the LBP condition or ability to self-manage appear to play a significant role when patients reflect on the outcomes achieved. These findings suggest that the targets of measurement process for physiotherapy effectiveness need to be expanded, in order to introduce meaningful outcome domains to patients with CLBP.

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6. GENERAL DISCUSSION

This thesis aimed to gain a better understanding of the relationship between patient-relevant outcome domains and those usually used in research to evaluate the effectiveness of physiotherapy in patients with CLBP. This knowledge may help to challenge and update current outcome measurement models, improving their validity and clinical relevance by integrating the perspective of patients.

In following sections, the main findings of this thesis are discussed as a whole and without the detail presented in individual studies. Strengths and limitations are also described and implications for clinical practice and research are discussed.

6.1. Main Findings

Through a sequence of studies, this research provided evidence supporting the gap between the outcome domains usually measured on physiotherapy research and meaningful improvements as perceived by patients with CLBP undergoing physiotherapy. Although the domains of pain and disability are widely used to determine the effectiveness of physiotherapy, they showed not to be sufficient to capture the set of important outcomes perceived by patients. Other patient-relevant outcomes were identified, suggesting that current outcome measurement model may be partially covering the physiotherapy outcome set. The current outcome measurement model for physiotherapy treatments need to be rethought and probably expanded to reflect other meaningful outcomes for patients such as medication intake, sleep quality, ability to self-management and sense of well-being and normality.

There was a lack of systematized knowledge in the way researchers assessed physiotherapy outcomes in patients with CLBP. Study 1 addressed this gap, describing the outcome domains, outcome measures and cut-off values used in randomized controlled trials of physiotherapy interventions. A high diversity of outcome domains (52 different domains) and measures (182 different measures) was found in the 195 included studies, which were in line with the results of previous systematic reviews that analysed the same issue in other health conditions (92,138,139). Although multiple COS have been published in recent decades (13), the absence of standardized outcome measurement models in the field of physiotherapy or CLBP may help to explain these findings. For this reason, the selection of outcome domains and

measures has probably been guided by practical considerations (e.g. the availability of instruments), the beliefs of researchers or convenience for individual studies. In addition, the complexity and the impact of CLBP in multiple health domains make the use of multiple outcome domains prone.

Despite this variability and inherent problems, our study showed that there is a particular consensus on the most used domains among studies. Pain intensity and disability domains were used in 87.7% and 84.6%, respectively, of the included studies. Other domains recommended by previous COS initiatives, such as health-related quality of life (11) or psychological functioning (12), were used in only about 20% of the studies. Furthermore, a poor compliance with the conceptual framework proposed by the PROMIS® initiative was found. Physical heath was measured in all included studies through the domains of pain or disability, while mental and global health was assessed in approximately 35% of the studies. Only 9.7% of the studies measured social health and an even smaller proportion (7.2%) measured the 4 core areas together. Analysis over time, according to the publication year of the primary studies, showed no relevant variations. First, the content validity of outcome assessment appears to be under threat because most studies fail to assess core areas of health outcomes. Second, the impact of CLBP extends beyond physical health, meaning that the physiotherapy outcomes in other potentially affected areas are largely unknown. Then, this problem was identified in most recent studies, showing that the effort to make outcome assessment of health interventions more comprehensive has been unsuccessful. As the outcome domains that cover physical health prevailed, the hypothesis that the biomedical model continues to guide the reasoning and choices (including outcome domains) of physiotherapists and researchers seems plausible.

As previously hypothesized, the findings of our systematic review confirmed that the effectiveness of physiotherapy treatment is largely measured by pain and disability domains. In addition, these outcome domains were defined as primary outcomes and used to interpret the clinical relevance of the results (by cut-off or MIC values) in most studies, which reinforces their importance for researchers. Accordingly, these findings guided the choice of independent variables and cut-off values to be used in our following analysis (studies 3 and 4). The main goal was to understand the extent to which researcher-relevant domains (pain and disability) were associated with the patients' perspective. Although valid and reliable measures to assess the domains of pain and disability were available in the European Portuguese language, it was necessary to identify a PROM to assess the patients' perspective. Based on specific recommendations for such measures (80), the GPES was chosen and the process of

its cross-cultural adaptation and the analysis of its psychometric properties was developed (study 2). The GPES-PT showed adequate psychometric properties, namely convergent validity, test-retest reliability and responsiveness. The ability of the GPES-PT to measure changes in health status over time (validity) was the main weakness pointed out in previous studies (81,87). In study 2, this concern was analysed by testing the contribution of the pre-intervention status to GPES-PT scores after a 6-week physiotherapy treatment (128). Our findings did not confirm limitations reported in previous studies, so the GPES-PT was used in the next steps of this research project. However, our analysis was conducted using short-term data and the use of the GPES-PT in medium and long-term follow-ups should be careful.

Looking at average changes or using cut-offs values, a large number of studies use pain and disability to interpret the success or failure of physiotherapy interventions in patients with CLBP (study 1). Therefore, these two domains have been seen by researchers as a proxy for the success of physiotherapy, as perceived by patients. Our findings from studies 3 and 4 did not support this assumption, showing that pain and disability domains do not adequately reflect meaningful improvements after physiotherapy treatment, as perceived by patients. Pain and disability changes showed a modest role to the patients' perception of improvement, accounting for a small proportion of variance of GPES-PT scores after a physiotherapy program (study 3). According to previous studies, this gap can be addressed (proportion of unexplained GPES-PT variance) by including other variables equally valued by patients (82,83). Therefore, this hypothesis also seems plausible to understand our findings. The risk of misrepresenting the outcomes of physiotherapy in patients with CLBP, when assessing only pain and disability, was reinforced.

Similarly, pain and disability cut-off values described in CLBP literature did not accurately identify patients who reported a successful response in GPES-PT (study 4). In study 4, we observed that a relevant proportion (18.5% to 50.9%) of patients who perceived a global improvement did not meet the researchers-defined criteria. Interestingly, this inconsistence was particularity observed to pain intensity cut-off values. In addition, the results of study 3 showed that changes in disability had a higher relative importance for GPES-PT scores than changes in pain intensity. These findings may seem unexpected, but several authors have argued that pain intensity may be a wrong indicator to infer the success of interventions in patients with chronic pain. Evans et al. (2014) described that patients with chronic neck pain do not believe in the complete recovery of their condition, so the value they give to pain intensity may be less than that expected by health professionals (107). These findings also help to

understand the fact that patients with acute LBP valued changes in pain intensity more than those with CLBP (114). The role of the type of intervention applied should also be discussed in the light of previous studies. For example, while pain intensity emerged as the main contributor to the patients' perception of improvement after pharmacological treatment (82), it appears to have a secondary role in patients undergoing psychological interventions (83). Based on findings of studies 3 and 4, positive changes in functional disability seem to play a greater role when patients assess the global improvements achieved with physiotherapy treatments. Finally, robust evidence has been published suggesting that people with musculoskeletal disorders adapt and adjust their daily life as a way to reduce the impact of pain (140,141). The meaning of pain, the cognitive appraisal of its impact, or the ability to "live around and despite the pain" seem to be more important to patients than pain intensity itself (16,20,140,141). Findings of study 5 seem to be aligned with this view, describing the "ability to self-manage" as a core theme for patients and related to other perceived physiotherapy outcomes.

Taken together, the findings of the studies 3 and 4 seem to support that patients value other outcome domains when they reflect on the overall gains achieved by the physiotherapy treatment. To address this hypothesis, study 5 was conducted using a mixed-methods design. From study 5, we found that patients with CLBP value a broader set of outcomes achieved with physiotherapy treatment. While some patient-perceived outcomes overlap with those used by researchers (e.g. "pain relief" and "return to function"), others less discussed and used in research emerged (e.g. "reducing medication intake", "improving sleep quality" or "ability to self-management"). For example, findings of study 1 showed that similar domains, such as "medication use", "sleep" and "self-efficacy", were assessed in a residual percentage of physiotherapy trials (2.6%, 1.5% and 4.1%, respectively). These additional outcome domains may help to explain the discrepancies found in study 3. Unlike those most commonly used by researchers (study 1), the outcomes identified from the patients' view cover the 4 core heath areas defined in the PROMIS® framework. The patients' perspective on perceived outcomes clearly extends beyond the area of physical health, suggesting that a biopsychosocial view should be equally applied in the field of outcome measurement. As hypothesized from the results of studies 3 and 4, the findings of study 5 suggest that patient-perceived outcomes have been partially measured, which supports the lack of validity of current outcome measurement models.

Despite potential conceptual differences, the outcome domains "pain relief", "return to function" or "sense of well-being and normality" are conceptually similar to those

described in previous qualitative studies with patients with musculoskeletal pain (85,107,142,143). However, other outcomes such as “gaining control over the LBP”, “reducing medication intake” and “improving sleep quality” have been less reported. To our knowledge, this was the first study to explore the perceived outcomes in patients with CLBP undergoing physiotherapy. In addition, some of the previous studies looked at patients' perspective before or during interventions, making their findings prone to the influence of expectations rather than to the specific outcomes of an intervention (19,142,143). For these reasons, it is plausible that some of the outcomes identified in our mixed-methods study differ from those described in previous studies and may be associated with the characteristics of our sample and mechanisms of action and goals of the applied physiotherapy treatments.

At this point, the perceived outcome “gaining control over the LBP” is an example of particular importance due to the characteristics of the condition. CLBP is a long-term condition wherein a significant proportion of patients do not fully recover after interventions, maintaining residual or fluctuating pain levels (31,144,145). Empowering patients to manage their condition autonomously is therefore critical and widely recommended (57). However, this has not been considered a potential outcome to be measured in CLBP research. From the analysis of study 5, it emerged as a core perceived outcome and was related to other relevant gains for the patients (“ability to self-management”; “return to function”; and “sense of well-being and normality”). These findings reinforce the need to measure representative outcome domains of knowledge, self-control or confidence perceived by patients to deal with their condition. Furthermore, they provide preliminary evidence about potential physiotherapy outcomes that may differ from other interventions.

As discussed above, the widespread use of pain and disability by researchers has probably been influenced by and is in line with the various outcome measurement models proposed over the past two decades (13). Other domains have been proposed in the various initiatives, but the inconsistencies between them and their lack of specificity may have contributed to the use of a reduced number of outcome domains. The set of findings of this thesis raises issues about the agreement between the way the physiotherapy outcomes have been measured, the existing conceptual frameworks and, mainly, the patients' view on the potential outcomes of physiotherapy in CLBP. The patients' view is more particularly aligned with the conceptual frameworks than with the core outcome set recently developed for people with LBP that remains restricted. The reduced participation and preponderance of patients in these initiatives may help to explain these differences (60,105). While the patients' perspective fits the

biopsychosocial model (study 5), physiotherapists and researchers seem to continue to be conditioned by the biomedical view, valuing, mainly, physical health domains (study 1).

The influence of the current assumptions for the development of COS should also be discussed. It has been argued that this type of outcome measurement models should integrate the outcome domains to be used in all clinical trials (66,67). Other outcome domains can be used according to the applied interventions and objectives of the researchers (66,67). This rationale facilitates the comparison between interventions, but fosters the variability of the other used outcome domains and keeps the COS away from the biopsychosocial perspective and from what is valued by patients. Outcome measurement models with two levels of outcome domains can adequately respond to these challenges. Considering the consensus around the domains of pain and disability, they would tend to integrate a first level of domains to be measured in all clinical trials. Then, a second level of domains to be used in all physiotherapy trials would have the potential to guarantee the specificity and scope needed to accurately capture the specific outcomes of physiotherapy in patients with CLBP. A list of domains found in the analyses carried out in studies 1 and 5 can be an important contribution to update and promote consensus on the outcome measurement model for physiotherapy treatments in patients with CLBP.

6.2. Strength and Limitations

The findings of this thesis should be interpreted in the light of its main strengths but also considering some limitations.

- Strength

To our knowledge, this is the first set of studies addressing this topic not only in the field of physiotherapy, but also in a sample of patients with CLBP. Previous studies have often used mixed samples integrating people with acute, subacute and chronic low back pain. These three subgroups have quite distinct characteristics (50–52), whose influence on the outcomes obtained and valued with physiotherapy is expected. Preliminary evidence from previous studies has supported this hypothesis (114). Likewise, the findings of studies carried out in the context of other interventions are

usually, but wrongly, generalized to the clinical practice and research in physiotherapy. As reported in previous studies, interventions tend to have specific outcomes that in turn are perceived differently by patients. Our research considered both concerns and provides new knowledge about a specific population exposed to a specific context of health intervention. In the field of outcome research and COS, the patient's view has been overlooked or considered together with that of multiple stakeholders. Thus, and as widely described in recent literature, little attention has been paid to the patient's perspective regarding the measurement targets of health interventions. An important strength of this thesis was to adopt a patient-centred approach, namely to use a specific PROM to capture the patient's perception of improvement and to conduct a specific research task to explore the patient's view. Finally, a set of procedures and methods were adopted in order to enhance the external validity of our findings. More specifically, our systematic review included studies regardless of their methodological quality, providing a comprehensive overview of the outcome domains and instruments used worldwide. In addition, the two prospective cohort studies integrated data from multiple clinical settings in different regions of Portugal. Together with the adequate sample size, these factors contributed to the heterogeneity of our samples and, thus, to the potential transferability of our results.

- Limitations

A relevant part of our work was based on GPES-PT. Although it showed adequate properties in study 2, its main limitation (propensity to recall bias) was analysed using only short-term data (6 weeks). In our studies 3, 4 and 5, the GPES-PT was used at 8 and 12 weeks (in the case of study 3) after the beginning of physiotherapy treatment and, therefore, its validity for these recall periods cannot be fully guaranteed.

This thesis aimed to clarify "what outcome domains should be measured" instead of "what instruments should be used". However, to address part of our objectives (objective 3 and 4), it was necessary to choose PROMs to assess the domains of pain and disability. We followed current guidelines to identify appropriate PROMs (122) (NPRS and QBPDS), but some concerns must be raised. First, the Portuguese version of NPRS was not formally cross-culturally adapted and validated. Despite its simplicity and wide use, this is not enough to assume with certainty that the NPRS provides an adequate measurement of the pain intensity domain in Portuguese samples. This lack of knowledge about its psychometric properties is not an exclusive problem to the

Portuguese context and more high-quality studies are needed on a global scale (123). In addition, this measure is composed of a single item, although it has been used to assess a complex and multidimensional experience. Therefore, the use of a multi-item scale could be more appropriate to provide accurate information about the pain intensity. Second, adequate psychometric properties have been found in the Portuguese version of the QBPDS (146,147), but some weaknesses have been identified in recent systematic reviews (148,149). For instance, low or very low quality evidence has been found on the content validity of this scale, suggesting limitations in its unidimensionality, and relevance, comprehensiveness and comprehensibility for evaluating disability in patients with LBP (148). These limitations are probably related to their initial development and their impact on the findings of our research is unknown.

Our thesis aimed to analyse and describe potential benefits (outcome domains) directly from the patient and not using experimental methods. Therefore, and mainly in study 5, no causal relationship can be established between the applied physiotherapy intervention and the identified outcome domains. This means that part of the outcomes described by the patients cannot be unequivocally attributed to the physiotherapy treatment because a wide range of factors (e.g. natural course of disease; previous experiences) can influence the outcomes perceived by them. While there is robust evidence to support improvements in pain and disability as potential outcomes of physiotherapy treatments, the same cannot be assumed in relation to the others described in study 5.

6.3. Implications for practice and future research

One of the main reasons for conducting this sequence of studies and analysis was the growing recognition that the measurement process of physiotherapy outcomes inadequately captures and reflect the outcomes perceived by patients with CLBP. This thesis provides evidence supporting this hypothesis, challenging the way outcomes of physiotherapy have been measured and the researchers' perspective on it. This set of new findings may contribute to bridging the gap between researchers and patients, improving the validity and accuracy of outcome measurement models, namely through the integration of a set of patient-relevant domains that are not usually measured. Therefore, the reinforcement of the importance of the patient's view and the way it should inform the outcomes assessment of physiotherapy are important implications of this thesis. However, this thesis addresses a small part of the process and methods

involved in the health outcome measurement, and its findings should be seen as a contribution to future research in this topic.

Specifically, further studies may be needed to clarify the role of the various identified outcome domains. The findings from study 1 and 5 (systematic review and mixed-methods study) do not provide evidence on whether the various identified domains are outcome mediators or outcomes in themselves. For example, “improving sleep quality” has been identified as a potential physiotherapy outcome related to improvements in pain intensity (study 5). However, it is not possible to infer whether these two domains are independent outcomes of physiotherapy or if one of them precedes and leads to the other. To clarify this point, a longitudinal study including multiple assessments of the various domains and mediation analyses is required.

In study 3, it was possible to quantify the relative importance of (absolute and percentage) changes in pain and disability for the global patients’ perception of change. Additionally, in study 4, the cut-off value that best identifies a meaningful improvement as perceived by patients was identified. In a clinical point of view, these findings can assist physiotherapists in making decisions about whether to continue treatments or not. Although a more comprehensive outcome assessment is urgent, our findings support that the percentage changes in functional disability, namely those greater than 30%, are the criterion that best relates to the view of success of the patient with CLBP undergoing physiotherapy. Therefore, as long as there are no new data on this topic, these recommendations should be adopted in the clinical practice and research of physiotherapy.

This does not mean, however, that our findings should not inform new researches aiming to improve the quality and validity of the outcome measurement of physiotherapy. For example, a new study, similar to study 3, including a wider set of variables (identified in study 1 and 5), may provide new insights into the relevance and relative weight of other outcome domains for the global patients' perception of change. Furthermore, the list of outcome domains identified in our systematic review and in the mixed-methods study may inform the development of a sequence of new studies with the aim of reaching consensus on a COS to be measured in all physiotherapy studies with patients with CLBP. The variability of domains and instruments found in our systematic review clearly reinforces the urgency to standardize the physiotherapy outcomes measurement in this population. First, an international survey involving physiotherapists, researchers and patients can be helpful in establishing a list of consensual outcome domains. Second, the right PROMs (or subscales or items) for each outcome domain must be found. Finally, the new outcome measurement model

must be refined through psychometric methods, in order to analyze the potential overlap of domains and its structural validity. These sets of steps, as well as the involvement of the various stakeholders, are of great importance to increase its use in research and its clinical relevance. In addition, its specificity regarding the intervention and health condition may overcome the limitations of previous initiatives.

Looking at the current literature on outcomes research, two trends have been observed: (1) The development of multiple domain PROMs (instead of a measure for each domain) in order to facilitate its use in clinical context and reduce the time spent and mistakes associated with its completion; (2) The definition of response criteria to analyse the effectiveness of interventions at an individual level, simplifying the interpretation of results and promoting the translation into clinical practice (90,137). Our research aimed to contribute to the development of a more comprehensive, patient-centred and valid outcome measurement model. Therefore, our findings may also have implications for the development of a multi-domain PROM and response criteria to physiotherapy for patients with CLBP.

As reported in previous studies, our findings support that the patients' perception of change is a complex and multidimensional concept comprising other domains beyond pain and disability. Through the relationship with the GPES-PT, we found that pain and disability changes show modest associations and tend to represent a small part of this concept. These findings may have important implications for how MIC are defined. MIC for pain and disability have been defined through the anchor method that uses measures of global perception of change (e.g. GPES) as an external criterion (150). An important premise is that these global measures show an association of at least 0.5 with pain and disability changes (128,151), something that was not demonstrated in our studies. PROMs of global perception of change capture changes in multiple health domains and therefore their use to define MIC in specific domains, such as pain and disability, should be rethought. The use of global ratings of concept instead of global ratings of change should be analysed in future studies (152).

Finally, our findings may have implications for the development of new interventions and the reinterpretation of the effectiveness of those analysed so far. First, identified outcome domains may help researchers to develop interventions aiming specific targets that are relevant to patients with CLBP, but have been undermeasured (and undertreated). New interventions targets, such as "improving sleep quality" or "ability to self-management", should be considered not only in effectiveness studies, but also in development and feasibility studies of new interventions. Second, the current understanding of the most effective physiotherapy interventions in patients with CLBP

emerges from the interpretation and comparison of their effectiveness on pain intensity and functional disability. As widely discussed in this thesis, these two outcome domains seem to capture only partially the physiotherapy outcomes perceived by patients. From our findings, we cannot state unequivocally that the effectiveness of physiotherapy has been over or underestimated, but this hypothesis seems relevant to clarify in future studies. Therefore, this thesis may be an important contribution to rethink the choices of physiotherapist and decision-makers in relation to the most effective treatments to be offered and funded.

7. CONCLUSIONS

The findings of this thesis contributed to the understanding of the relationship between outcome domains used in physiotherapy research and the patients' perspective. Three main conclusions can be drawn:

- The current measurement of the physiotherapy outcomes partially covers the core health areas of the PROMIS® framework and does not seem to consider the well-documented impact of CLBP on multiple domains of health and life. Researchers have widely used the outcome domains of pain intensity and functional disability to investigate the effectiveness of physiotherapy interventions. These (physical) outcome domains appear to be overvalued in research, while others covering mental and social health areas are rarely considered.

- Pain intensity and disability changes during physiotherapy treatments demonstrated a moderate association with and explained partially the global patients' perception about their improvements. In addition, usual cut-off and MIC values in these two outcome domains were not reliable indicators of global improvements as perceived by patients. These findings suggest that outcome domains usually used in physiotherapy research do not capture the set of outcomes perceived by patients with CLBP undergoing physiotherapy.

- Patient with CLBP perceived gains in several health domains that ranged beyond those most used in physiotherapy research. Pain intensity and functional disability ("return to function") emerged together with others patient-perceived outcomes, such as "reducing medication intake", "improving sleep quality", "ability to self-manage" and "sense of well-being and normality". This set of potential physiotherapy outcomes cover multiple health and life areas and it should be considered in the measurement process of physiotherapy effectiveness.

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ANNEXES

Annexe I - Authorization from the Portuguese Data Protection Authority

Annexe II - Authorization from the Ethics Committee of the Local Health Unit of Castelo Branco

Annexe III - Questionnaire booklet

Annexe IV - Written information about the studies and informed consent

Annexe I - Authorization from the Portuguese Data Protection Authority

N/Ref. 02.02
Proc. n.º 19925 / 2017
Of. nº 37925
Data: 2017-12-06

Assunto: Notificação de tratamento de dados de investigação clínica

Com referência ao assunto em epígrafe, ficam V. Exas. notificados de todo o conteúdo da decisão desta CNPD nº 13626/ 2017 proferido em 06-12-2017, cuja cópia se anexa.

Com os melhores cumprimentos.

A Secretária da CNPD

(Isabel Cristina Cruz)

Autorização n.º 13626/ 2017

Diogo André da Fonseca Pires notificou à Comissão Nacional de Protecção de Dados (CNPD) um tratamento de dados pessoais com a finalidade de realizar um Estudo Clínico com Intervenção, denominado Desenvolvimento de um modelo de avaliação de resultados para a intervenção da Fisioterapia em utentes com Dor Lombar Crónica .

A investigação é multicêntrica, decorrendo, em Portugal, nos centros de investigação identificados na notificação.

O participante é identificado por um código especificamente criado para este estudo, constituído de modo a não permitir a imediata identificação do titular dos dados; designadamente, não são utilizados códigos que coincidam com os números de identificação, iniciais do nome, data de nascimento, número de telefone, ou resultem de uma composição simples desse tipo de dados. A chave da codificação só é conhecida do(s) investigador(es).

É recolhido o consentimento expresso do participante ou do seu representante legal.

A informação é recolhida diretamente do titular.

As eventuais transmissões de informação são efetuadas por referência ao código do participante, sendo, nessa medida, anónimas para o destinatário.

A CNPD já se pronunciou na Deliberação n.º 1704/2015 sobre o enquadramento legal, os fundamentos de legitimidade, os princípios aplicáveis para o correto cumprimento da Lei n.º 67/98, de 26 de outubro, alterada pela Lei n.º 103/2015, de 24 de agosto, doravante LPD, bem como sobre as condições e limites aplicáveis ao tratamento de dados efetuados para a finalidade de investigação clínica.

No caso em apreço, o tratamento objeto da notificação enquadra-se no âmbito daquela deliberação e o responsável declara expressamente que cumpre os limites e condições aplicáveis por força da LPD e da Lei n.º 21/2014, de 16 de abril, alterada pela Lei n.º 73/2015, de 27 de junho – Lei da Investigação Clínica –, explicitados na Deliberação n.º 1704/2015.

O fundamento de legitimidade é o consentimento do titular.

A informação tratada é recolhida de forma lícita, para finalidade determinada, explícita e legitima e não é excessiva – cf. alíneas a), b) e c) do n.º 1 do artigo 5.º da LPD.

Assim, nos termos das disposições conjugadas do n.º 2 do artigo 7.º, da alínea a) do n.º 1 do artigo 28.º e do artigo 30.º da LPD, bem como do n.º 3 do artigo 1.º e do n.º 9 do artigo 16.º ambos da Lei de Investigação Clínica, com as condições e limites explicitados na Deliberação da CNPD n.º 1704/2015, que aqui se dão por reproduzidos, autoriza-se o presente tratamento de dados pessoais nos seguintes termos:

Responsável – Diogo André da Fonseca Pires

Finalidade – Estudo Clínico com Intervenção, denominado Desenvolvimento de um modelo de avaliação de resultados para a intervenção da Fisioterapia em utentes com Dor Lombar Crónica

Categoria de dados pessoais tratados – Código do participante; idade/data de nascimento; género; dados antropométricos; dados da história clínica; dados de qualidade de vida/efeitos psicológicos

Exercício do direito de acesso – Através dos investigadores, presencialmente

Comunicações, interconexões e fluxos transfronteiriços de dados pessoais identificáveis no destinatário – Não existem

Prazo máximo de conservação dos dados – A chave que produziu o código que permite a identificação indireta do titular dos dados deve ser eliminada 5 anos após o fim do estudo.

Da LPD e da Lei de Investigação Clínica, nos termos e condições fixados na presente Autorização e desenvolvidos na Deliberação da CNPD n.º 1704/2015, resultam obrigações que o responsável tem de cumprir. Destas deve dar conhecimento a todos os que intervenham no tratamento de dados pessoais.

Lisboa, 06-12-2017

A Presidente

Filipa Calvão

Annexe II - Authorization from the Ethics Committee of the Local Health Unit of Castelo Branco

ULS
Unidade Local de Saúde
de Castelo Branco, EPE

Ofício: Diogo André Fonseca Pires

Assunto: Projecto de investigação em Fisioterapia em doentes com dor lombar crónica (DLC)

Requerente: Diogo André Fonseca Pires – Aluno do Doutoramento em Saúde Pública da ENSP

Titulo: Pedido de autorização para realização de um projecto de investigação em Fisioterapia cujo objectivo principal é desenvolver um modelo de avaliação de resultados para a intervenção da Fisioterapia em doentes com dor lombar crónica (DLC) , tendo como orientador do estudo a Prof. Dra. Carla Nunes Pedro Abreu e co-orientador o Prof. Dr. Eduardo Cruz

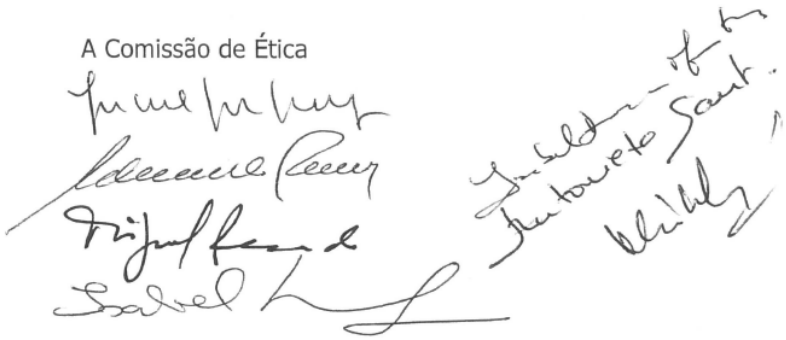
População do estudo: doentes do C.S. S.Miguel e na Unidade da Dor da ULSCB

Data do pedido: Ofício datado no HAL de 06 de Dezembro de 2017

A Comissão de Ética da ULSCB, concorda com o referido estudo desde que seja mantida a confidencialidade dos sujeitos do mesmo, todos os princípios éticos inerentes ao processo de investigação sejam respeitados e com a devida autorização da Directora Executiva do ACES BIS e da Responsável da Unidade da Dor.

ULS de Castelo Branco, E.P.E., 12 de Janeiro de 2018

A Comissão de Ética



Annexe III – Questionnaire booklet

INSTITUTO POLITÉCNICO DE SETÚBAL- ESCOLA SUPERIOR DE SAÚDE
DEPARTAMENTO DE FISIOTERAPIA

QUESTIONÁRIO DE CARACTERIZAÇÃO SÓCIO-DEMOGRÁFICA E CLÍNICA

DOR LOMBAR CRÓNICA

Data do preenchimento do questionário: ____/____/____

DADOS SOCIO-DEMOGRÁFICOS

1. Idade _____ **2. Sexo:** Masculino ☐ Feminino ☐

3.Peso (kg): _____ **4. Altura (cm):** _____

5.Qual o seu Estado Civil? (escolha uma das seguintes opções):

Solteiro(a) ☐ Casado(a) ☐ União de Facto ☐ Viúvo(a) ☐ Divorciado(a) ☐

6.Quais são as suas Habilitações Literárias? (escolha uma das seguintes opções):

Ensino Primário ou inferior ☐ Ensino Básico completo (9º ano de escolaridade) ☐ Ensino Secundário ou equivalente completo (12º ano de escolaridade) ☐ Ensino Superior completo ☐

7.Qual é sua situação profissional?

A trabalhar ☐ Incapaz de trabalhar devido ao seu problema ☐ Desempregada (o) ☐ Reformada (o) ☐ Doméstica (o) ☐

8. É Fumador? (escolha uma das seguintes opções)

Sim ☐ Ex-fumador ☐ Não ☐

DADOS CLÍNICOS

9. Há quanto tempo tem dor lombar? (escolha uma das seguintes opções)

3-6 meses ☐ 6-12 meses ☐ 12-24 meses ☐ Mais de 24 meses ☐

10. A sua dor prolonga-se para a perna?

Sim ☐ Não ☐

Questionário de Caracterização Sócio - Demográfica e Clínica - Autores: Caeiro, C., Cruz, E. e Fernandes R., Pires, D. e Costa, D. (Outubro 2011). Atualizado 2012. Atualizado 2015.

11. Atualmente toma alguma medicação para a sua dor lombar?

Sim ☐ Não ☐

12. No último ano faltou ao trabalho devido à sua dor?

Sim ☐ Não ☐

12.1.Se sim, quantas vezes?

1 vez ☐ 2 vezes ☐ 3 vezes ☐ Mais de 3 vezes ☐

12.2. Durante quanto tempo (total de dias ou semanas que faltou no último ano)?

1 dia ☐ 2 dias ☐ 3 dias ☐ 1 semana ☐ Mais de 1 semana ☐

13. No último ano esteve de baixa remunerada (estado, seguros, empregador, etc)?

Sim ☐ Não ☐

14. Durante o último mês sentiu: (escolha uma das seguintes opções)

	Nunca	Algumas vezes	Muitas vezes
Dores de estômago?	☐	☐	☐
Dores nos braços, pernas ou noutras articulações além das costas?	☐	☐	☐
Dores de cabeça?	☐	☐	☐
Dor difusa ou dor em grande parte do corpo?	☐	☐	☐

15. Na última semana sentiu-se (escolha uma das seguintes opções)

	Nunca	Raramente	Às vezes	Frequentemente	Sempre
Inútil	☐	☐	☐	☐	☐
Desamparado	☐	☐	☐	☐	☐
Depressivo	☐	☐	☐	☐	☐
Sem esperança	☐	☐	☐	☐	☐

16. Na última semana... (escolha uma das seguintes opções)

	Nunca	Raramente	Às vezes	Frequentemente	Sempre
O meu sono foi reparador	☐	☐	☐	☐	☐
Tive problemas em adormecer	☐	☐	☐	☐	☐
Acordei várias vezes durante a noite	☐	☐	☐	☐	☐

17. Nos últimos 7 dias....

	Nada	Um pouco	Um tanto	Muito	Bastante
Quanto é que o seu problema afectou as atividades do seu dia-a-dia?	☐	☐	☐	☐	☐
Quanto é que o seu problema afectou as suas atividades em casa?	☐	☐	☐	☐	☐
Quanto é que o seu problema afectou a sua participação em atividades sociais?	☐	☐	☐	☐	☐
Quanto é que o seu problema afectou as suas tarefas domésticas?	☐	☐	☐	☐	☐

18. Não é seguro para uma pessoa com a minha condição física ser fisicamente ativa

Discordo plenamente ☐ Discordo ☐ Concordo ☐ Concordo plenamente ☐

19. Sinto que as minhas costas estão cada vez piores e nunca vão melhorar.

Concordo ☐ Discordo ☐

20. Por favor, assinale o número que melhor representa a intensidade média da sua dor HOJE.

Sem Dor	0	1	2	3	4	5	6	7	8	9	10	Dor Máxima

EXPETATIVAS COM O TRATAMENTO DE FISIOTERAPIA

21. No final do tratamento de fisioterapia, espera que a sua dor lombar? (coloque um circulo à volta do número que melhor corresponde à sua opinião)

1	2	3	4	5
Esteja pior	Esteja na mesma	Esteja ligeiramente melhor	Esteja melhor	Desapareça

22. No final do tratamento de fisioterapia, espera que a capacidade para realizar as suas atividades do dia-a dia? (coloque um circulo à volta do número que melhor corresponde à sua opinião).

1	2	3	4	5
Esteja pior	Esteja na mesma	Esteja ligeiramente melhor	Esteja melhor	Completamente recuperada

QUEBEC BACK PAIN DISABILITY SCALE- VERSÃO PORTUGUESA

Este questionário pretende saber como a sua dor nas costas afecta a sua vida no dia-a-dia. Pessoas com dores de costas poderão achar difícil a realização de algumas atividades diárias. Nós gostaríamos de saber se acha difícil a realização de algumas das atividades listadas abaixo, devido à sua dor de costas. Para cada atividade há uma escala de 0 a 5. Por favor escolha uma opção de resposta para cada atividade (**preencha todas as atividades**) colocando uma cruz no quadrado que corresponde à sua resposta.

Hoje, tem dificuldade em realizar as seguintes atividades devido à sua dor de costas?

		0 Sem dificuldade nenhuma	1 Com Um mínimo de dificuldade	2 Com alguma dificuldade	3 Com bastante dificuldade	4 Com muita dificuldade	5 Incapaz de realizar
1	Levantar-se da cama						
2	Dormir toda a noite						
3	Virar-se na cama						
4	Andar de carro						
5	Estar de pé durante 20-30 minutos						
6	Estar sentado numa cadeira por várias horas						
7	Subir um lance de escadas						
8	Andar 300-400 metros						
9	Andar vários quilómetros						
10	Alcançar prateleiras altas						
11	Atirar uma bola						
12	Correr cerca de 100 metros						
13	Tirar comida do frigorífico						
14	Fazer a cama						
15	Calçar meias (*collants*)						
16	Dobrar-se à frente para limpar a banheira						
17	Mover uma cadeira						
18	Puxar ou empurrar portas pesadas						
19	Carregar dois sacos de compras						
20	Levantar e carregar uma mala pesada						

Adicione todos os números para obter um **score total:** _____

Cruz E. B., Fernandes R., Carnide F. Moniz, S., Viera, A.C. Nunes, F. (2013). Cross-Cultural Adaptation and Validation of the Quebec Back Pain Disability Scale to European Portuguese Language. *Spine*, 38 (23), pp E1491 - E1497. Versão Original de Kopec et al. (1995). *Spine*. 20(3): 341-352.

Annexe IV – Written information about the studies and informed consent

ESCOLA NACIONAL DE SAÚDE PÚBLICA – UNIVERSIDADE NOVA DE LISBOA

Desenvolvimento de um modelo de avaliação de resultados para a intervenção da Fisioterapia em utentes com Dor Lombar Crónica

Diogo Pires; Eduardo Cruz; Carla Nunes (2018)

CARTA EXPLICATIVA DO ESTUDO

[Estudo 3 e 4]

O meu nome é Diogo Pires, sou Fisioterapeuta e estou a desenvolver um estudo sobre os benefícios da intervenção da Fisioterapia em indivíduos com dor lombar crónica. Este estudo faz parte do meu projeto de doutoramento, a decorrer na Escola Nacional de Saúde Pública – Universidade Nova de Lisboa.

O propósito deste estudo é analisar a relação entre os efeitos da Fisioterapia na intensidade da dor e incapacidade funcional com a perspetiva de melhoria global reportada pelos indivíduos com dor lombar crónica. A informação recolhida neste estudo poderá, no futuro, contribuir para melhorar a forma como os fisioterapeutas avaliam e interpretam os resultados da Fisioterapia tendo em consideração a própria perspetiva dos indivíduos com esta condição de saúde.

A recolha de dados será realizada em 2 momentos pré-definidos: antes do início das sessões de fisioterapia e posteriormente no final da 8ª semana ou no momento de alta. Nestes momentos será convidado a preencher alguns questionários que pretendem conhecer algumas das suas características pessoais, da sua dor lombar, das dificuldades que tem em realizar tarefas ou atividades por causa da sua dor, e da forma como acha que a sua condição têm evoluído. Todo o material recolhido será codificado e tratado de forma anónima e confidencial, sendo conservado à responsabilidade do Fisioterapeuta Diogo Pires. Os códigos que permitem a identificação indireta dos participantes serão eliminados cinco anos após o fim do estudo.

Os resultados do estudo serão apresentados no âmbito da apresentação da Tese do Doutoramento em Saúde Pública – Especialidade de Epidemiologia, nunca sendo os participantes identificados de forma individual.

A escolha de participar ou não no estudo é voluntária. O presente estudo não acarreta qualquer risco potencial, não trazendo também qualquer vantagem direta para os que

nele participam e não irá interferir no plano de tratamento que lhe será aplicado pelo seu Fisioterapeuta. Se decidir participar no estudo, poderá abandonar o mesmo em qualquer momento sem ter que fornecer qualquer tipo de explicação.

Caso surja alguma dúvida, ou necessite de informação adicional, por favor contacte: Diogo Pires através do número 961 131 468 ou do email piresdiogo.af@gmail.com

Certo que o seu contributo irá ajudar a desenvolver este estudo, agradeço antecipadamente a sua colaboração e disponibilidade.

Os meus melhores cumprimentos,
O investigador: Diogo André da Fonseca Pires

ESCOLA NACIONAL DE SAÚDE PÚBLICA – UNIVERSIDADE NOVA DE LISBOA

Desenvolvimento de um modelo de avaliação de resultados para a intervenção da Fisioterapia em utentes com Dor Lombar Crónica

Diogo Pires; Eduardo Cruz; Carla Nunes (2018)

CARTA EXPLICATIVA DO ESTUDO

[Estudo 5]

O meu nome é Diogo Pires, sou Fisioterapeuta e estou a desenvolver um estudo sobre os benefícios da intervenção da Fisioterapia em indivíduos com dor lombar crónica. Este estudo faz parte do meu projeto de doutoramento, a decorrer na Escola Nacional de Saúde Pública – Universidade Nova de Lisboa.

O propósito deste estudo é compreender a perspetiva dos indivíduos com dor lombar crónica acerca dos diferentes benefícios da intervenção da Fisioterapia. A informação recolhida neste estudo poderá, no futuro, contribuir para melhorar a forma como os fisioterapeutas avaliam e interpretam os resultados da Fisioterapia tendo em consideração a própria perspetiva dos indivíduos com esta condição de saúde.

A recolha de dados será realizada em 3 momentos pré-definidos: antes do início das sessões de fisioterapia, no final da intervenção e posteriormente num momento a definir até ao máximo de 2 semanas após a intervenção. Nos dois primeiros momentos será convidado a preencher alguns questionários que pretendem conhecer algumas das suas características pessoais, da sua dor lombar, das dificuldades que tem em realizar tarefas ou atividades por causa da sua dor, e da forma como acha que a sua condição têm evoluído. Por sua vez, no 3º momento será convidado a participe numa entrevista com cerca de 6-8 indivíduos, conduzida por dois investigadores que lhe irão colocar algumas questões sobre os benefícios sentidos (ou não) por si com a intervenção de Fisioterapia. É esperado que esta entrevista não tenha uma duração superior a uma hora e meia e será realizada num horário que lhe seja conveniente.

Todo o material recolhido será codificado e tratado de forma anónima e confidencial, sendo conservado à responsabilidade do Fisioterapeuta Diogo Pires. Os códigos que permitem a identificação indireta dos participantes serão eliminados cinco anos após o fim do estudo. No caso particular da entrevista, esta será gravada em formato áudio, contudo a sua identidade permanecerá confidencial nomeadamente através da utilização de um nome fictício aquando da transcrição da mesma.

Os resultados do estudo serão apresentados no âmbito da apresentação da Tese do Doutoramento em Saúde Pública – Especialidade de Epidemiologia, nunca sendo os participantes identificados de forma individual.

A escolha de participar ou não no estudo é voluntária. O presente estudo não acarreta qualquer risco potencial, não trazendo também qualquer vantagem direta para os que nele participam e não irá interferir no plano de tratamento que lhe será aplicado pelo seu Fisioterapeuta. Se decidir participar no estudo, poderá abandonar o mesmo em qualquer momento sem ter que fornecer qualquer tipo de explicação.

Caso surja alguma dúvida, ou necessite de informação adicional, por favor contacte: Diogo Pires através do número 961 131 468 ou do email piresdiogo.af@gmail.pt.

Certo que o seu contributo irá ajudar a desenvolver este estudo, agradeço antecipadamente a sua colaboração e disponibilidade.

Os meus melhores cumprimentos,
O investigador: Diogo André da Fonseca Pires

ESCOLA NACIONAL DE SAÚDE PÚBLICA – UNIVERSIDADE NOVA DE LISBOA

Desenvolvimento de um modelo de avaliação de resultados para a intervenção da Fisioterapia em utentes com Dor Lombar Crónica

Diogo Pires; Eduardo Cruz; Carla Nunes (2018)

CONSENTIMENTO INFORMADO

Reconheço que os procedimentos de investigação descritos na carta anexa me foram explicados e que todas as minhas questões foram esclarecidas de forma satisfatória. Compreendo igualmente que a participação no estudo não acarreta qualquer tipo de vantagens e/ou desvantagens potenciais.

Fui informado(a) que tenho o direito a recusar participar e que a minha recusa em fazê-lo não terá consequências para mim. Compreendo que tenho o direito de colocar agora e durante o desenvolvimento do estudo, qualquer questão relacionada com o mesmo. Compreendo que sou livre de, a qualquer momento, abandonar o estudo sem ter de fornecer qualquer explicação.

Assim, declaro que aceito participar nesta investigação, com a salvaguarda da confidencialidade e anonimato e sem prejuízo pessoal de cariz ético ou moral.

O Participante

_____

_____, ____ de _____ de 20____

Fisioterapeuta responsável pelo estudo:

_____

Diogo Pires